APPENDIX A

WATER AVAILABILITY ANALYSIS AND CUMULATIVE FLOW IMPAIRMENT INDEX:

Appropriative Application 30717
Applicant David Jenks
Submitted July 10, 2006

Water Availability Analysis
and
Cumulative Flow Impairment Index

California Water Resources Control Board
Division of Water Rights

Appropriative Application 30717
Applicant David Jenks

PROFESSIONAL GEOLOGIST
Matthew D. O'Connor
No. 6847
STATE OF CALIFORNIA

Prepared by

Matt O'Connor, PhD, PG #6847
Brenda Rosser, MSc

O'Connor Environmental, Inc.
P.O. Box 794
Healdsburg, CA 95448

First Draft Submitted September 27, 2004
First Draft Comments Received Dated November 9, 2004
Revised Draft Submitted January 17, 2005
Revised Draft Comments Received Dated March 21, 2005
Second Revision Submitted April 26, 2005
Third Revision Submitted November 17, 2005
Fourth Revision Submitted March 16, 2006
Fifth Revision Submitted July 10, 2006

1. Introduction

The purpose of this report is to summarize the results of the Water Availability Analysis conducted for Appropriative Application A030717 of David Jenks. The analysis includes calculation of the Cumulative Flow Impairment Index (CFII) of Floodgate Creek directly above its confluence with the Navarro River, and at three other "Points of Interest" (POI's).

POI's were provided to O'Connor Environmental, Inc. (OEI) via e-mail on August 2, 2004 by Mitchell Moody, Water Resource Control Engineer, Division of Water Rights, as per recommendation by the Department of Fish and Game. The POI's were described as follows:

POI #1: The point immediately downstream of the POD.

POI #2: The point immediately above the confluence of the unnamed stream and Floodgate Creek.

POI #3: The point immediately above the confluence of Floodgate Creek and the Navarro River.

At the request of DWR transmitted by Joe Bandel via e-mail November 22, 2005, an additional POI was analyzed. This supplemental POI is located below the confluence of the unnamed stream and Floodgate Creek and is identified as POI 2.1.

Attachment A is a map of the project watershed, and identifies the POI's used in this analysis, the proposed point of diversion for the application, and all other known diversions within the Floodgate Creek watershed. Watershed areas were determined using a point-count method and USGS topographic maps.

2. Project Description

This project is an existing 3.81 ac-ft reservoir located on a drainage swale tributary to Floodgate Creek, a tributary to the Navarro River. The water right application is for 3.81 ac-ft. The site is located 11 miles northwest of Boonville in southwestern Mendocino County. The application seeks diversion to storage from December 15 through March 31. Water will be used for irrigation of approximately 1 acre of existing vineyard, and for re-establishment of native vegetation and landscaping.

3. Methods

Streamflow at the POI's is estimated based on a proration of USGS streamflow data using the gauge on the Navarro River (USGS 11468000 Navarro R nr Navarro Ca). The following formula was used:

Q(POI) = Q(NR) * [A(POI)/A(NR)]*[(I(POI)/I(NR)]

Where Q(POI) = Seasonal flow (ac-ft) at POI
Q(NR) = Seasonal flow (ac-ft) at Navarro River gauge
A(POI) = watershed area (sq. mi) above POI

A(NR) = watershed area (sq. mi) above Navarro River gauge
I(POI) = Precipitation above POI (ft/yr)
I(NR) = Precipitation above gauge (ft/yr)

4. Seasonal unimpaired flow

The period of concern recommended for use in determining seasonal unimpaired flow is December 15 to March 31. Unimpaired flow is the total volume of water, on average, that would flow past the POI on a seasonal basis if no diversions (impairments) were taking place in the watershed above the POI. Flow is measured in acre-feet.

a. Data and assumptions

Streamflow data collected by the USGS at the Navarro River gauge, and shown in Appendix A of "Water Availability Analysis for Anderson Creek and Rancheria Creek Tributary to Navarro River, Mendocino County", prepared by Napa Valley Vineyard Engineering, Revised January 26, 2004" (the Navarro WAA), is comprised of 52 years of record. Because the data is measured flow, it is considered impaired flow. In the Navarro WAA unimpaired flow at the gauge is determined by adding the upstream water demand to the gauge data. The unimpaired flow as determined in the Navarro WAA is used in this analysis to prorate the streamflow at the POI's. The average annual precipitation for Floodgate Creek and the Navarro River was estimated at 3.3 feet per year (40 inches) using the rainfall map in Appendix C of the Navarro WAA; a copy of this map is provided as Attachment B.

Values used in the computation of Q(POI 3) were:

Q(NR) = 294,442.2 ac-ft (per Navarro WAA, p. 3)
A(POI 3) = 2.75 mi^2
A(NR) = 303 mi^2 (per Navarro WAA, p. 3)
I(POI3) = 40"
I(NR)1 = 43.2"

Values used in computation of Q(POI 2) and Q(POI 1) were identical except for drainage areas as follows:

A(POI 2.1) = 1.38 mi^2
A(POI 2) = 0.54 mi^2
A(POI 1) = 0.0066 mi^2

Computed values of seasonal runoff are as follows:

Q(POI 3) = (294,442.2) * (2.75/303) * (40/43.2) = **2,474 ac-ft**
Q(POI 2.1) = (294,442.2) * (1.38/303) * (40/43.2) = **1,244 ac-ft**
Q(POI 2) = (294,442.2) * (0.54/303) * (40/43.2) = **486 ac-ft**
Q(POI 1 = POD) = (294,442.2) * (0.0066/303) * (40/43.2) = **5.9 ac-ft**

Estimates of annual yield obtained from the rational runoff method (per DWR methodology) for POI 2, POI 2.1 and POI 3 were similar (see Table 1 and map of subwatersheds Attachment C). For POI 1 (POD), however, the rational runoff method produced an estimate of annual runoff (14.1 ac-ft), more than twice that produced by the proration method (5.9 ac-ft).

Based on the proration method runoff estimates, the 3.81 ac-ft of surface water proposed for the water right permit represents about 0.8 % of the surface water generated from rainfall in the watershed draining to POI 2, and about 0.15 % of the surface water generated from rainfall for Floodgate Creek (POI 3).

Table 1

			Runoff coefficient factors					
sub-basin	Area	Avg annual ppt (ft)	relief	soil sat	vegetation	surface storage	Runoff coefficient C	Q=CIA (ac-ft/yr)
1	401	3.3	0.21	0.07	0.07	0.07	0.42	556
2	539	3.3	0.19	0.07	0.12	0.06	0.44	**783**
3 (**POI 2**)	346	3.3	0.21	0.07	0.06	0.06	0.40	**457**
2 + 3 (**POI 2.1**)								**1240**
4	234	3.3	0.28	0.07	0.04	0.12	0.51	394
5	401	3.3	0.20	0.07	0.06	0.07	0.40	530
(Sum) **POI 3**								**2720**
(POD) **POI 1**	9.3	3.3	0.20	0.07	0.1	0.09	0.46	**14.1**

Note: refer to map in Appendix C for sub-basin locations.

b. CFII

The CFII is an index used to evaluate the cumulative flow impairment of all existing and pending projects in the watershed of interest. The CFII is a percentage obtained by dividing demand by supply at the POI for a specified period, December 15 to March 31 of the following year.

The recommended protocol for calculating CFII defines demand as the "face value" of all existing and pending water rights above the POI measured in acre-feet. Existing rights were identified based on a review of SWRCB DWR files. Demand includes Statements of Water Diversion and Use, Small Domestic Registrations, Stockpond certificates, Appropriative Applications, Permits, and Licenses. The water rights application of record within the Floodgate Creek watershed identified using the Division of Water Rights files are summarized in Table 2. Applicants with junior rights are identified in Table 2. Use categories shown in Table 2 are defined in Table 3.

Case A CFII evaluates the applicant's appropriation plus senior rights; total demand for the applicant and senior water rights at POI 3 is 73.4 ac-ft (Table 4). Case B CFII evaluates the applicant's appropriation plus senior and junior rights; total demand for the applicant and senior and junior water rights at POI 3 is 136.91. CFII for Case A and Case B at each POI, calculated cumulatively through the watershed, are summarized in Table 4a for unimpaired runoff estimated by the flow proration method and in Table 4b for unimpaired runoff estimated by the rational runoff method (per Table 1). CFII is calculated as (demand/supply)*100.

Table 2

Permit #	POI	Storage (ac-ft)	Season	Use
A030717	1	3.81	12/15 to 3/31	I, FP, R, H, W
A030930*	2	20	12/15 to 3/31	FP, I
A029907	2	6	12/15 to 3/31	FP, I HP
A029672	2	19	11/1 to 3/31	FP, I
D030714R	3	4	12/1 to 5/31	D
D030713R	3	3	10/1 to 5/31	–
A30872*	2.1	20*	9/1 to 5/31	I, FP
A029305	2.1	18.6	10/1 to 4/30	–
S014960	2.1	19	**	SW,I
A031004*	3	15*	1/25 to 4/15	I, SW, FP
D030905R*	3	8.5	10/1 to 4/30	D
		136.91		

* Junior rights to 030717
** riparian right dating from ~ 1920; no season of diversion specified
diversion capacity ~ 500 gpm;

Table 3

Use categories	
I	Irrigation
F	Fire Protection
FP	Frost Protection
R	Recreation
H	Heat Protection
W	Wildlife Enhancement
D	Domestic
SW	Stock water
p	Pending application

Table 4a-CFII Summary by Flow Proration Method

	Supply (unimpaired flow) ac-ft	Case A Demand-- Applicant + Senior (ac-ft)	Case B Demand-- Applicant + Senior + Junior (ac-ft)	Case A CFII (%)	Case B CFII (%)
POI 1	5.9	3.81	3.81	64.2	64.2
POI 2	486	28.81	48.81	5.9	10.0
POI 2.1	1244	66.41	106.41	5.3	8.6
POI 3	2474	73.41	136.91	3.0	5.5

Table 4b-CFII Summary by Rational Runoff Method

	Supply (unimpaired flow) ac-ft	Case A Demand-- Applicant + Senior (ac-ft)	Case B Demand-- Applicant + Senior + Junior (ac-ft)	Case A CFII (%)	Case B CFII (%)
POI 1	14.1	3.81	3.81	27.0	27.0
POI 2	457	28.81	48.81	6.3	10.7
POI 2.1	1240	66.41	106.41	5.4	8.6
POI 3	2719	73.41	136.91	2.7	5.0

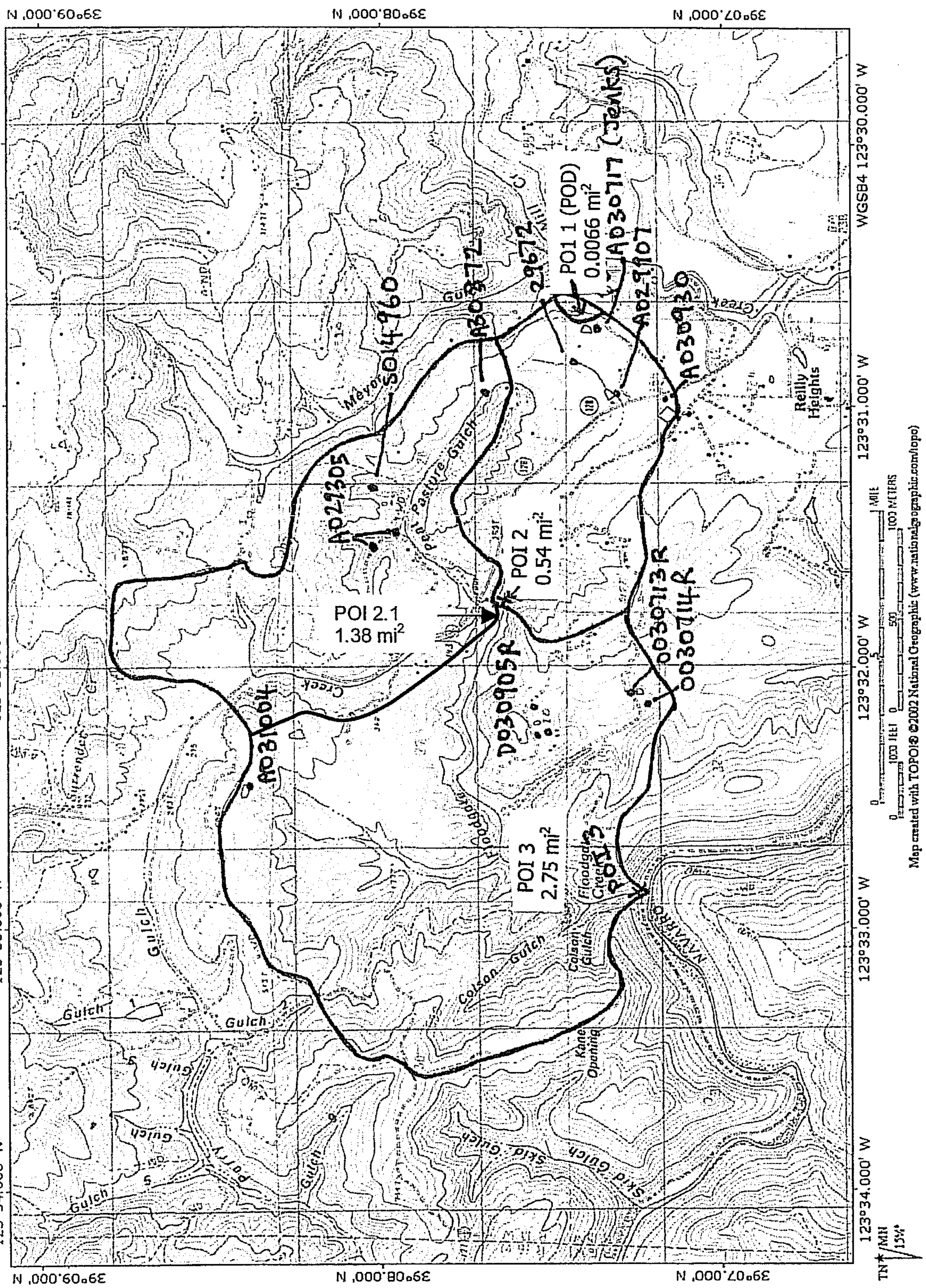
5. Bypass Flows

The median February flow has been identified as a target bypass flow where needed to protect fish habitat. The median flow for the Point of Diversion (POI 1) was estimated by prorating the median of February mean daily flow at the Navarro River gauging station (#11468000) based on the period of record currently available from the USGS (WY 1951-2004). Based on 1,526 days of record in the month of February, the median daily flow 598 cfs.

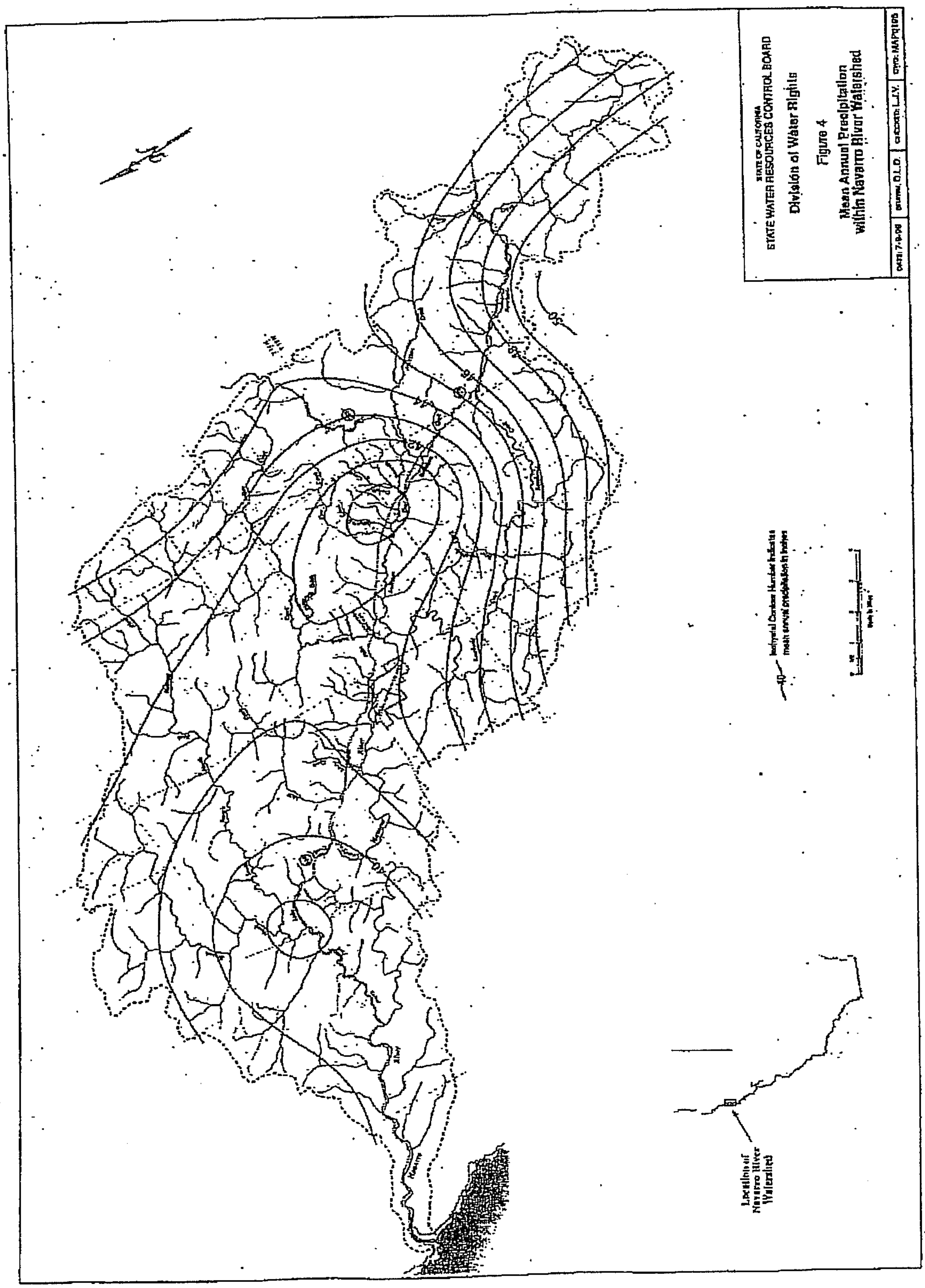
The median daily flow for the Navarro River was multiplied by the ratio of drainage area above the diversion (0.0066 sq. mi.) to the drainage area above the Navarro River gauge (303 sq. mi.) to compute the estimated median February flow at the diversion:
598 cfs x (0.0066/303) = 0.013 cfs. This is equivalent to 5.8 gpm or 0.026 ac-ft/day. If bypass flows equivalent to the median daily flow occurred for the full duration of the October 15 to March 31 diversion season, the total volume of water bypassed would be 2.78 ac-ft (107 days x 0.026 ac-ft/day)

The data set and spreadsheet calculations used to estimate median February flows from the USGS gauge records for the Navarro River described above have been submitted electronically on a CD accompanying this document.

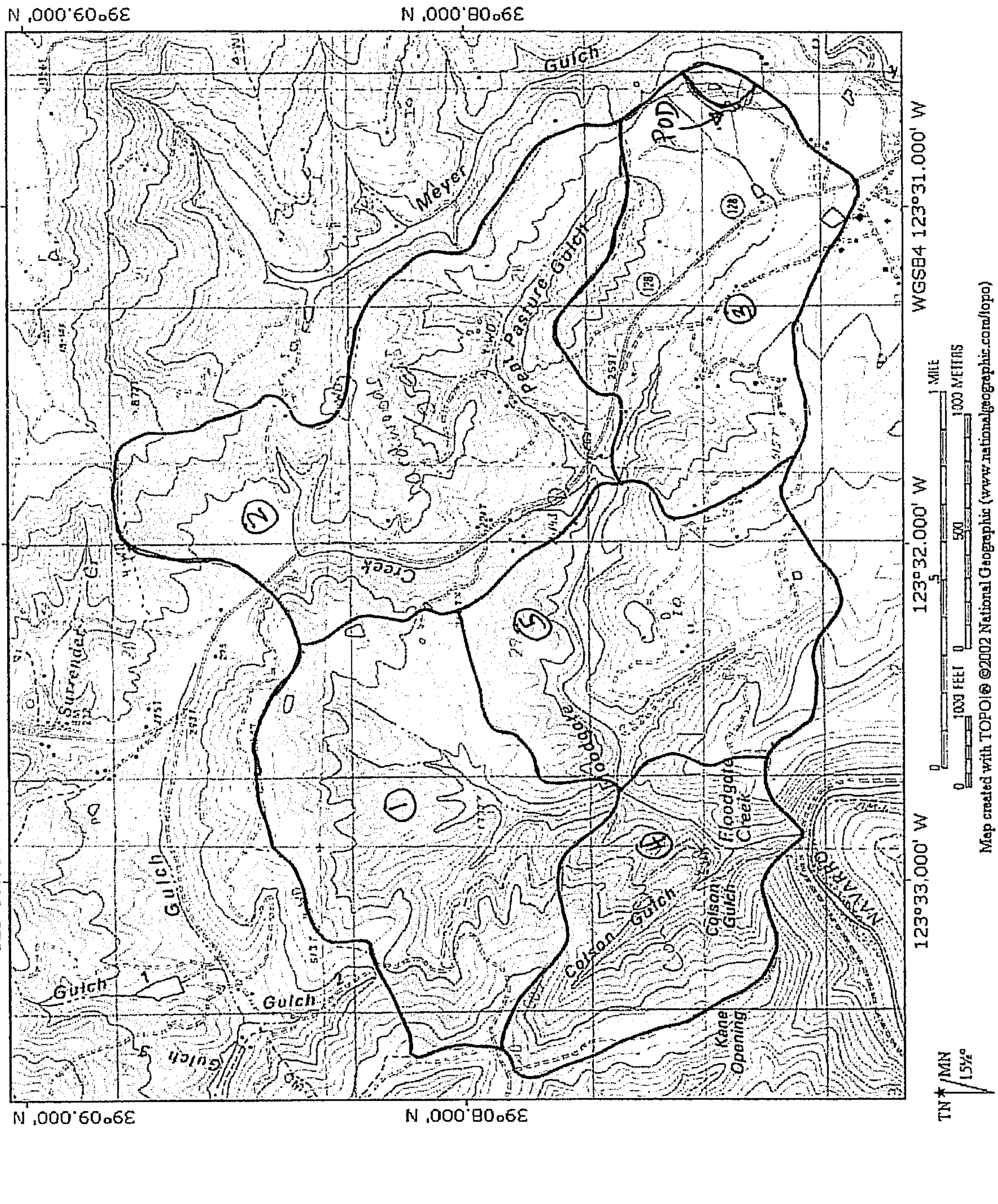
Attachment A



Attachment B



Attachment C



APPENDIX B

FISHERY ASSESSMENT OF UNNAMED TRIBUTARY TO FLOODGATE CREEK

Preliminary Fishery Assessment of Unnamed Tributary to Floodgate Creek

Re: Division of Water Rights Appropriative Application 30717

Prepared for:
O'Connor Environmental Inc.
P.O. Box 794, Healdsburg, CA 95448
(707) 431-2810

By:
Gary Reedy
Consulting Fisheries Ecologist
P.O. Box 177
Occidental, CA 95465
(707) 874-9984

~~March 15, 2006~~
Revised April 6, 2006

Introduction

On January 10, 2006 I examined the unnamed tributary to Floodgate Creek subject to Division of Water Rights Appropriative Application 30717. My purpose was to assess the availability and quality of anadromous fish habitat in the unnamed tributary (hereafter called Stream) between the applicant's site of diversion and confluence with Floodgate Creek. This report provides my preliminary assessment and includes information gathered from personal communications and existing information, including what is compiled in KRIS Navarro (www.krisweb.com). An appendix provides captioned site photos and additional map images.

The applicant would divert to storage 3.81 acre-feet within the period December 15 through March 31. Potential habitat use by anadromous fish during this period would be spawning by coho salmon (*Oncorhynchus kisutch*) and steelhead trout (*Oncorhynchus mykiss*), or winter rearing by juveniles of the two species. Coho salmon is listed as endangered and steelhead is listed as threatened under the Endangered Species Act. No other sensitive fish species are found in tributaries of the Navarro River.

Watershed Characteristics

The Stream drains a 0.54 sq. mile watershed that is covered by redwoods in the lowest elevations and otherwise dominated by vineyard. Grassland and hardwood forest are dispersed throughout the middle and upper watershed. The watershed is entirely owned in private parcels ranging in size from approximately 1 to 100 acres. Hwy 128 traverses the watershed, crossing the creek near its headwaters and offering views of the creek as it flows through a large vineyard.

A complete barrier to migration by anadromous fish is located approximately 130' upstream of the Hwy 128 crossing, and 0.25 miles below the applicant's point of diversion (Figure 1). The creek flows 0.97 miles from this barrier to Floodgate Creek. The Gschwend Road stream crossing provides a logical demarcation between lower and middle segments of the Stream. This crossing is 0.50 miles upstream from Floodgate Creek and approximately 0.10 miles downstream from the boundary of a large vineyard. The lower segment flows through a dense canopy of redwood forest. Table 1 describes the three segments of the Stream referred to throughout this report. Over the lower and middle segments, the creek drops approximately 150 feet and has an overall gradient of 3.3%.

The Stream is classified as intermittent by the USGS (dashed stream line in Figure 1) and does not appear on the 1:100000 stream layer from the California Department of Fish and Game (KRIS Navarro). I assume the Stream to be Class 2 in the California Department of Forestry system of stream classification with the possibility of Class 1 depending upon as yet unavailable information on fish. Although Floodgate Creek above the Stream and Peat Pasture Gulch is shown on the USGS map as perennial, I observed that the Stream is larger at its confluence with Floodgate Creek than either Peat Pasture Gulch or Floodgate Creek above Peat Pasture Gulch.

The Stream's watershed is dominated by vineyard and the stream is apparently impacted by this land use through accelerated erosion, diminished riparian and channel simplification. Sediment may be the most significant impact. As part of the Total Maximum Daily Load for sediment, the North Coast Regional Water Quality Control Board (RWQCB) made the following statement:

> Road-related sediment is the dominant source of management-related sediment delivery across the Navarro watershed landscape. Vineyards have the potential to be locally significant, while use of conservation measures such as cover crops and contouring, as well as avoidance of areas prone to erosion can reduce the amount of sediment eroded. Regional Board staff believes that the potential for significant reductions of sediment delivery from vineyard erosion is great, based on the fact that most vineyards in the Navarro watershed are not incorporating the previously mentioned conservation practices. The vineyard density in some smaller watersheds, such as Mill, Lazy, and Floodgate creeks, has great potential to degrade the habitat in those small streams if conservation practices are not employed.

The two or more acres around the applicant's storage pond are a conspicuous area of vineyard reconversion to forest. Erosion control measures are also evident on the property.

Figure 1. The watershed of the unnamed tributary of Floodgate Creek is outlined in black. The lower and middle segments are noted by arrows that point to the confluence, Gschwend Road crossing, and a barrier to upstream migration by fish.

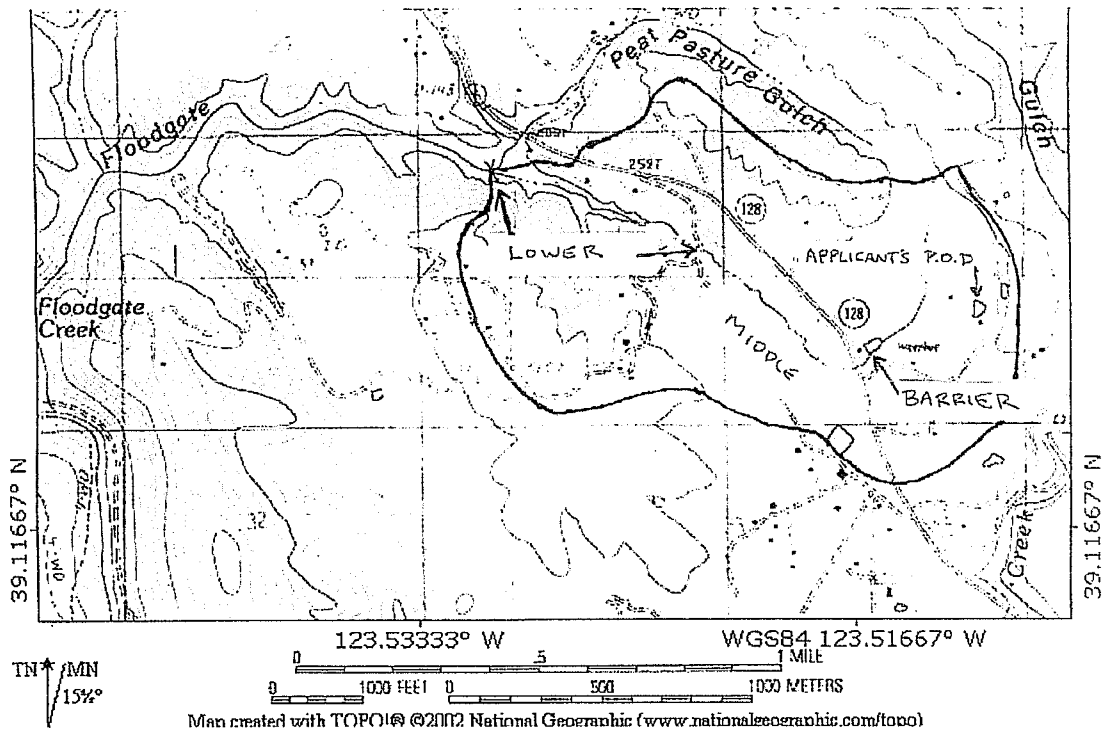


Table 1. Length and character of three segments of the unnamed tributary to Floodgate Creek.

Segment	Length (mi)	Land Cover	Anadromous Fish Habitat[1]
Lower	0.50	Forest	Fair to good; see text of results
Middle	0.47	Vineyards	Poor, if any; no riparian trees and artificially straightened channel.
Upper	0.25	Mixed vineyards, grass, hardwoods	None; inaccessible

1. Assuming no barriers to migration in Floodgate Creek; Evaluations are based on noted features and professional judgment.

Existing Information on Fish and the Stream

Existing records of fish or habitat in the Stream do not exist. Existing records of fish in the Floodgate Creek watershed are limited to the ½ mile above the confluence with the Navarro River. The California Department of Fish and Game (CDFG) conducted a habitat survey of lower Floodgate Creek on July 24, 1996. Data from this survey indicate water temperature and pool habitat in lower Floodgate Creekwere are suitable for anadromous fish.

No additional documentation from CDFG on fish or habitat in the Floodgate Creek watershed exists (Doug Albin, pers. com.). Since 1999, CDFG has annually surveyed tributaries of the Navarro River for the presence or absence of coho salmon. For unknown reasons, Floodgate Creek has not been included in these surveys.

The Mendocino Redwood Company and its predecessor, Louisiana Pacific, used electrofishing or snorkelers to quantify fish at a Floodgate Creek monitoring station. The station (82-30) was located near the mouth, measured 69-90 feet in length, and consisted of one pool and adjacent riffles. It was surveyed in the summer of 1994, 1995, 1996, and 2001. Steelhead were found on each occasion. No coho were found. Other fish included prickly sculpin, Pacific brook lamprey, California roach, and three-spine stickleback. Water temperatures taken on these surveys ranged from slightly above what is suitable for coho salmon rearing (16.8 deg. C; Welsh et al. 2001) to as low as 13.6 C in 2001. All recorded temperatures were within the suitable range for steelhead rearing (Sullivan et al. 2000).

Other than maps, no information exists on the approximately 2-mile long segment above the lowest ½ mile and below the Stream confluence. Figure 2 shows three road crossings of Floodgate Creek in this segment. The entire Stream may be inaccessible to anadromous fish due to migration barriers. The range of steelhead trout is more extensive than that of coho salmon due to greater ability to ascend obstacles (Bell 1990, Furniss et al. 1991), so it also remains possible that the stream is occasionally used by steelhead and inaccessible to coho salmon.

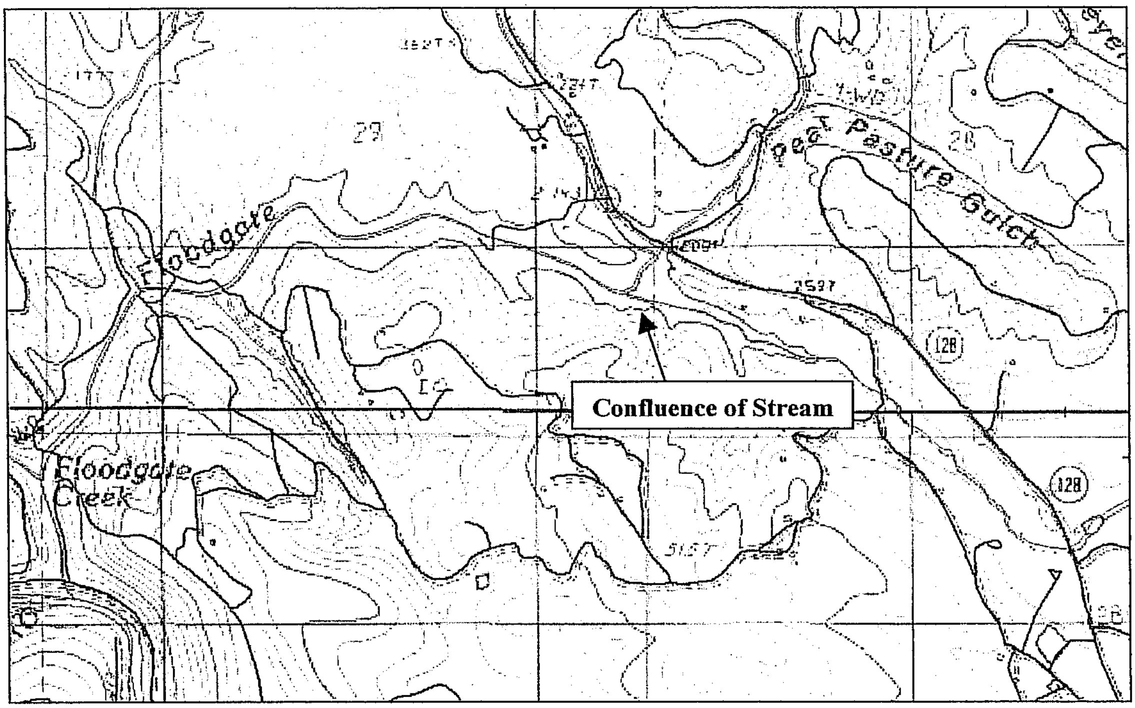


Figure 2: Three spatial data layers from KRIS Navarro Map Project: 1) Road layer developed by the RWQCB in 2000 from maps and aerial photographs, 2) Stream layer (1:24000) from the USGS, and 3) Topo layer (1:24000) from USGS. The map indicates three road crossings of Floodgate Creek below confluence with the Stream. Note that both stream crossings of the Stream below Gswend Road do not appear on the road layer, suggesting that the layer is incomplete.

Survey Methods and Constraints

I was unable to contact all the landowners required for full access to the creek before this survey. Eva Glover, the property owner living at the junction of Gschwend Road and Hwy 128, permitted my access to the lower segment of the creek. I observed the middle segment from the Hwy 128 easement, and the upper segment from Guntley Road.

I walked the lower section of the creek in both directions while wearing polarized sunglasses and attempting to observe fish. I visually evaluated salmonid habitat features, probed pools for depth, and took photos of potential barriers to migration. At two typical run habitats, I took measurements of depth and velocity. Velocity was measured by timing the travel of a soggy stick over a 6-foot course.

My visit occurred ten days after a large flood event in the area. In the morning of December 31, the Navarro River peaked at 55,700 cfs, a discharge exceeded only twice in over 50 years of gage records. During the site visit, the Navarro River was flowing

950 cfs and still slowly declining. I observed channel conditions as newly changed from a 10-20 yr hydrologic event and this condition affected the appearance of some habitat features. Bank vegetation was notably scoured or flattened in many locations. Large deposits of sediment on the floodplain were conspicuously new and without vegetation. Some accumulations of woody debris appeared newly formed and tenuous.

This survey did not quantify fish or habitat features. Habitat measures were visually estimated unless otherwise noted. Habitat evaluations were based on professional judgment unless otherwise noted.

Survey Results

The Stream has three road crossings and a waterfall in the lower segment. None of these appeared to be a complete barrier to upstream migration of adult anadromous fish based on a visual judgment of how height and velocity would vary with flow levels. However, two road crossings appear to be partial barriers. An unmarked dirt road crosses the creek approximately 1000' from the mouth. This crossing, made of a 2.5' diameter culvert and fill, is a partial barrier to fish migration. Gschwend Road crosses the creek with a 5' x 8' box culvert which has a natural grade and appears to be no barrier to fish migration. A 5' vertical waterfall is located approximately 1500' from the mouth and is a barrier to upstream migration of juvenile salmonids at all but very high flows (Appendix Photo 5).

Hwy 128 crosses the middle segment by a culvert that may be a partial barrier to migration. A complete barrier exists 130' upstream, at the top of the middle segment, in the form of a steep culvert (6' vertical outfall) beneath a driveway.

The lower segment had a moderately confined channel, an abundance of large wood, and a dense coniferous canopy. More than 30% of the channel length was pool habitat and some pools were greater than four feet deep. I noted numerous backwater pools and alcoves that would provide winter rearing habitat for salmonids at high flows. The average width of the channel was 6 feet. The channel varied from unentrenched to slightly entrenched. Substrate was predominately silt, sand and gravel. Based on visual estimates substrate size and spawning habitat criteria (Smith 1973), potentially suitable spawning habitat for anadromous salmonids existed at approximately five sites. The substrate at these sites was moderately to highly embedded with fine sediments, and the location of these sites was skewed toward the mouth of the creek.

The maximum distance for observing fish and substrate conditions (visibility) was 1.9 feet. Water temperature was 54 degrees F. No fish were observed. Bullfrog tadpoles were observed in the largest pool, which was artificially deep and round.

Measured depths and velocities (Table 2) represent a very small sample of two fast water units. The riffle was located near the upper end of the lower segment and the run was located near the confluence with Floodgate Creek.

Table 2. Depths and velocities at two locations in lower segment of Stream.

Location	Width (ft)	Avg Depth (ft)	Max Depth (ft)	Velocity (ft/s)
Riffle near Gschwend Rd	6.5	0.36	0.50	0.68
Run near mouth	3.6	0.15	0.22	1.96

I visually estimated the flow in the creek to be 0.5 cfs at the Hwy 128 crossing, and 1.0 cfs at the mouth. I observed very small surface flow additions via swales located in the lower segment, and near the bottom of the middle segment. The primary contribution to flow appeared to be from a gradual increase in seepage from the water table as the stream decreased in elevation. At the point of confluence, I visually estimated that the creek contributes 35% of the flow in Floodgate Creek. Based on cross-sectional characteristics of the channel, I estimated the flow on the day of survey to be approximately 10% greater than winter base flow.

Mrs. Glover, who has resided at that location for more than 30 years, recalls seeing small fish in the pools of the creek during most, but not all summers. She has observed the creek to be dry between pools during each summer and estimated that this usually occurs beginning in June.

Conclusions

Although no fish were observed during the survey, it is entirely possible that salmonids were rearing in the Stream. Rainbow trout and juvenile steelhead trout commonly remain in cover throughout daylight hours during the winter in order to conserve energy (Contor and Griffith 1995, Cunjak 1996). The Stream is very small for an anadromous fish. Depth measurements indicate that adult anadromous salmonids would only be able to migrate up the Stream during storm run-off periods. It is unknown whether road crossings of Floodgate Creek permit any access to the Stream by anadromous fish.

If the Stream is accessible to anadromous salmonids, then the applicant's diversion is of concern with regard to potential impacts to spawning habitat, not rearing habitat. The lower Stream has high-quality rearing habitat in the form of deep pools and alcoves. This rearing habitat would not be impacted by slight to moderate reductions in flow during the winter.

The Navarro Watershed is sediment impaired (CRWQCB 2000) and this unnamed tributary to Floodgate Creek appears to be no exception in that regard. High levels of fine sediment at observed potential spawning sites appear to reduce the quality of spawning habitat and may be a limiting factor for salmonids using the Stream.

The small size of the Stream means that periods of potential access for anadromous fish are very limited and suitable spawning habitat does not exist when flows are less than

Gary D. Reedy, Consulting Fisheries Ecologist

P.O. Box 177 Occidental, CA 95465 (707) 874-9984 reedy@asis.com

winter base level. When flow does exceed the level necessary for spawning habitat, small reductions in flow (<10%) do not necessarily reduce the availability of spawning habitat. The relationship between spawning area and flow level is a steep inverted parabola (Bjornn and Reisner 1991). At higher flows, reductions can actually increase spawning habitat availability. Most significant is the timing and duration of flows corresponding with maximal spawning habitat.

Salmonid spawning begins in winter and continues to as late as April for steelhead. If the applicant satisfies storage before late January, his diversion would have minimal effect on spawning habitat. In general, early diversion as opposed to late diversion minimizes impacts to salmonid spawning.

A more thorough assessment of anadromous fish in the unnamed tributary and potential impacts from the applicant's diversion could be made with the following:

1. Permission from landowners to survey Stream in middle segment and near confluence (i.e. at 2300 Hwy 128).
2. Barrier assessment on Floodgate Creek and lower segment of creek using detailed measurements and fish passage software.
3. Quantification of spawning habitat for salmonids using substrate, depth and velocity criteria.
4. Spawning surveys during flow conditions suited to fish and redd detection in winter or early spring.
5. Juvenile salmonid surveys during summer.

References

Bell M. 1990. Fisheries Handbook of Engineering Requirements and Biological Criteria. Third. US Army Corps of Engineers, North Pacific Division. Portland, Oregon.

Bjornn, T.C., and D.W. Reisner. 1991. Habitat Requirements of Salmonids in Streams. In W.R. Meehan et al. (Ed.), Influences of Forest and Rangeland Management on Salmonid Fishes and their Habitats. American Fisheries Society, Bethesda, MD.

California Dept. of Fish and Game. 1996. Stream Inventory Report for Floodgate Creek. Provided electronically by Doug Albin.

California Regional Water Quality Control Board, North Coast Region. 2000. Navarro River watershed technical support document for the Total Maximum Daily Load of sediment. www.swrcb.ca.gov/northcoast/programs/tmdl/navarro/NavarroTSD.pdf

Gary D. Reedy, Consulting Fisheries Ecologist

P.O. Box 177 Occidental, CA 95465 (707) 874-9984 reedy@asis.com

Contor, Craig R., and J. S. Griffith. 1995. Nocturnal emergence of juvenile rainbow trout from winter concealment relative to light intensity. Hydrobiologia 299(3): 179-183.

Cunjak, R.A. 1996. Winter habitat of selected stream fishes and potential impacts from land-use activity. Can. J. Fish. Aquat. Sci. 53(S1): 267-282.

Furniss, M.J., T.D. Roelofs, and C.S. Yee. 1991. *Road Construction and Maintenance*. American Fisheries Society Special Publication 19:297-323.

Institute for Fisheries Resources. 2000. KRIS Navarro on-line and CD database. www.krisweb.com

O'Connor, M. and B. Rosser. 2005. Water availability analysis and cumulative flow impairment index for Appropriative Application 30717. O'Connor Environmental, Inc.

Smith, A. K. 1973. Development and application of spawning velocity and depth criteria for Oregon salmonids. Transactions of the American Fisheries Society 102:312-316.

Sullivan, K., D. J. Martin, R. D. Cardwell, J. E. Toll, and S. Duke. 2000. An analysis of the effects of temperature on salmonids of the Pacific Northwest with implications for selecting temperature criteria. Sustainable Ecosystems Institute, Portland, OR.

Welsh, H. H., G. R. Hodgson, B. C. Harvey, and M. F. Roche. 2001.Distribution of juvenile coho salmon (Oncorhynchus kisutch) in relation to water temperature in tributaries of the Mattole River, California. North American Journal of Fisheries Management.

Personal Communications

Doug Albin, California Department of Fish and Game. 1031 South Main Street, Suite An Ft Bragg CA 95437. (707) 964-7683

Appendix

Photo 1. This image is from a digital orthophotoquad (c. 1997) and encompasses the entire watershed of the creek. The applicant's pond is the smallest of the four ponds in the lower right quadrant. Roads are red and the map shows both Hwy 128 and Gschwend Road crossing the creek. From KRIS Navarro.

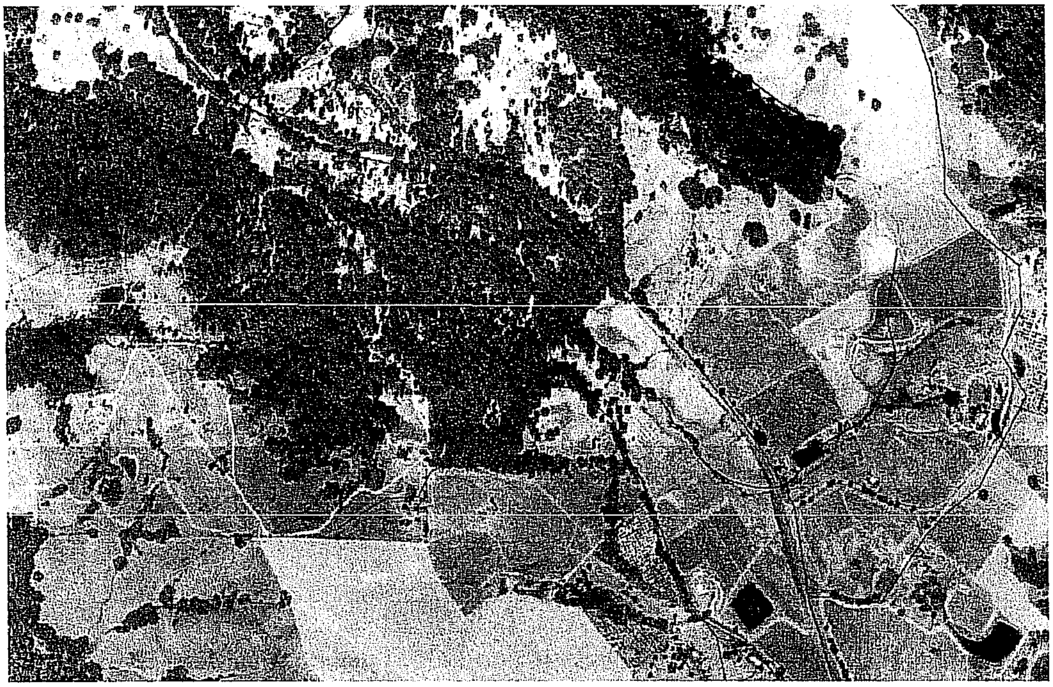


Photo 2. The unnamed tributary of Floodgate Creek (flows from left to right) where it leaves the open vineyard section and begins entering the forest. Note the swales joining on both far and near.

Photo 3. The lowest road crossing on the unnamed tributary to Floodgate Creek is a 3' diameter culvert. The crossing has a dip and was flooded several times within 10 days of the photo.

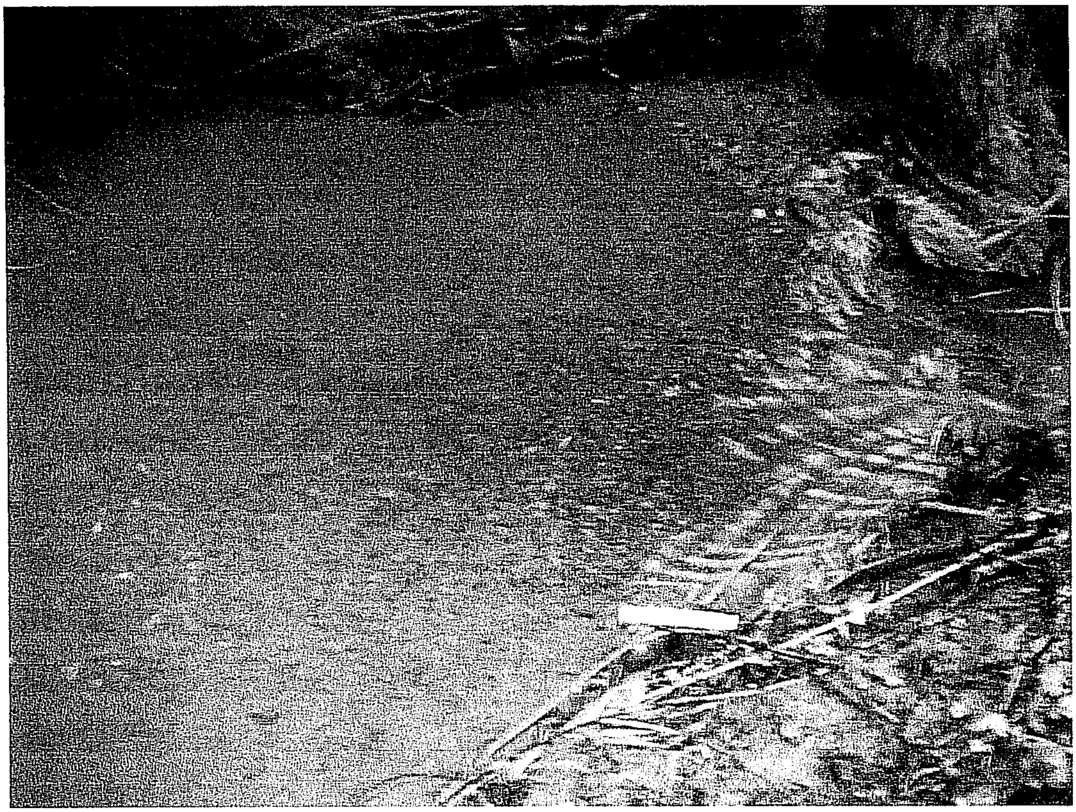
Photo 4. A typical pool-riffle sequence in the lower section of the unnamed tributary to Floodgate Creek. The channel is controlled by vegetated point bars and large wood.

Gary D. Reedy, Consulting Fisheries Ecologist

P.O. Box 177 Occidental, CA 95465 *(707) 874-9984* *reedy@asis.com*

Photo 5. A 5' vertical waterfall located approximately 1500' from the mouth of Unnamed Tributary to Floodgate Creek. This falls is a barrier to juvenile fish migration at all, except possiby high flows.

Photo 6. One of five sites in the lower section of the Unnamed Tributary to Floodgate Creek deemed to be suitable for steelhead spawning based on visual criteria for depth, velocity and substrate.



APPENDIX C

FINAL NAVARRO WATERSHED ANALYSIS

STATE OF CALIFORNIA - THE RESOURCES AGENCY

DEPARTMENT OF FISH AND GAME
POST OFFICE BOX 47
YOUNTVILLE, CALIFORNIA 94599
(707) 944-5500

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
777 Sonoma Avenue, Room 325
Santa Rosa, California 95404

In Reply Refer to: 151416SWR03SR9025:WH

November 12, 2003

Mr. Steven Herrera
State Water Resources Control Board
P. O. Box 2000
Sacramento, California 95814

Dear Mr. Herrera:

Applicants for water rights in the Navarro River watershed have been working with State Water Resources Control Board (SWRCB) staff to assess both the availability of water for proposed water rights and impacts of new water rights on fisheries and other resources. In particular, Napa Valley Vineyard Engineering, Inc. has been coordinating with SWRCB staff in the development of Cumulative Flow Impairment Indices (CFII) for the watershed. Computations of CFII are part of a process used to screen for potential impacts to anadromous salmonids (Department of Fish & Game and NOAA Fisheries 2002)[1]. Recently there has been considerable discussion between consultants for the applicants, SWRCB staff, Department of Fish & Game (DFG), and NOAA Fisheries concerning approaches for assessing and mitigating cumulative impacts of water diversions from tributaries of the Navarro River upon habitats and fishes in the downstream Navarro River mainstem. Existing assessment protocols call for examining whether total cumulative diversions between October and late March exceed 10% of estimated unimpaired winter runoff. If so, additional analysis and possible field studies may be needed to identify suitable bypass flows to protect fisheries resources in the mainstem. This letter recommends a possible approach that may simplify addressing potential cumulative impacts of water diversions upon Navarro River <u>mainstem</u> habitats. Use of "dual bypass flows" for new projects, similar to that recommended by our agencies for the Napa River watershed, would eliminate the need for computations of CFII for points on the river's mainstem. It would also circumvent the need for possible additional studies on the mainstem and related consultation if CFII exceeded 10% at Points of Interest (POIs) on the mainstem.

[1] DFG and NOAA Fisheries. 2002. Guidelines for maintaining instream flows to protect fisheries resources downstream of water diversions in mid-California coastal streams. California Department of Fish & Game, Sacramento, CA and the National Marine Fisheries Service, Santa Rosa, CA. June 17, 2002, errata note 8-19-02. 19pp.

At issue are the numerous small reservoirs in the Navarro River watershed that may store a significant portion of the runoff during fall and early winter. The cumulative diversions of these reservoirs may pose a risk to anadromous fisheries in the Navarro River mainstem, especially during periods of low flow. Therefore, it is reasonable that new water right permits be conditioned with terms that would avoid potential cumulative impacts to both the Navarro River mainstem and its tributaries.

DFG and NOAA Fisheries (2002) guidelines recommend that new diversions be limited to the relatively high flows of winter and that adequate bypass flows be maintained at all times. We recommend that the projects associated with pending water right applications be conditioned to occur only during the recommended winter flow season (December 15 - March 31) and that the projects maintain adequate bypass flows at the diversion site as recommended in the guidelines. Because the mainstem of the Navarro River may be a considerable distance downstream from the diversion site and the mainstem may be already exposed to significant cumulative diversions causing artificially low flows, it is reasonable to limit additional winter diversions in the watershed that may adversely affect conditions in the river's mainstem. This could be done by conditioning each of the new permits so that diversions at each new project adhere to the guidelines (*e.g.*, provide adequate bypass flows at the diversion site) and <u>in addition</u> limit diversions to times when flows in the Navarro River mainstem exceed levels needed to protect fish and wildlife resources in the mainstem.

The Navarro River mainstem and its anadromous fisheries resources would be protected by limiting new diversions to winter months and conserving winter spawning habitats for steelhead and coho salmon in the mainstem. Conservation of spawning habitats for these species is achieved by conserving and protecting the natural flow regime at levels that maximize spawning habitat for these species. Both species require periodic high flows that maintain the integrity of the channel and cleanse gravel substrates. In addition, stream flow conditions must provide suitable depths and velocities over spawning gravels during the periods of spawning and egg incubation. Optimal spawning habitat for steelhead is both deeper and faster (*i.e.,* higher water velocities) than that for coho spawning habitat (Briggs 1953 and Smith 1973)[2], and thus available steelhead spawning habitat is likely optimized at higher flows than optimal spawning flows for coho salmon. However, conservation of the natural flow regime throughout the late fall and winter at levels that adequately protect steelhead spawning habitat will also protect the natural flows that provide spawning habitats for coho salmon.

---

[2] Briggs, J.C. 1953. The behavior and reproduction of salmonid fishes in a small coastal stream. Fish Bull. No. 94, Dept. of Fish & Game, Sacramento, CA. 61 pp.
Smith, A.K. 1973. Development and application of spawning velocity and depth criteria for Oregon salmonids. Trans. Am. Fish. Soc. 102 (2): 312-316.

To estimate flows needed to optimize spawning habitat in the mainstem, we can utilize the work of Hatfield and Bruce (2000)[3] who found that optimal spawning flows for steelhead are largely related to Mean Annual Discharge (MAD). Based on a review of 1500 habitat-discharge relations for salmonids in western North America, Hatfield and Bruce developed regression equations for estimating flows that maximize available weighted usable habitat for various salmonid lifestages. However, before applying the Hatfield and Bruce techniques it is worth stating that optimal habitats for salmonids do not depend simply on a single flow, but rather they are dependent on maintaining dynamic stream flows. Hatfield and Bruce's techniques provide flow estimates that maximize available spawning habitat for a given set of channel conditions, but higher flows are usually needed to maintain channel form and high quality stream substrates.

Hatfield and Bruce's equation for steelhead spawning habitat in western North America is:

$$\log_e(\text{Optimum flow}) = -33.064 + 0.618 \cdot \log_e(\text{MAD}) + 7.260 \cdot \log_e(\text{longitude})$$

Using this analysis, it can be shown that optimal flow for steelhead spawning is dependent on watershed area and that optimal flows are proportionately lower in relatively large watersheds (*i.e.*, on a per square mile basis, optimal flow decreases as drainage area increases). To apply this method to the Navarro River it is necessary to know the MAD and longitude of the USGS gage at Navarro. A review of USGS data indicates that MAD in the Navarro River is about 525 cfs at Navarro[4], and the longitude of the gage is 123.667°. Using these data and the Hatfield and Bruce equation, it is estimated that the "optimal" flow for maximizing steelhead spawning habitat in the Navarro mainstem is 325 cfs.

A flow protective of salmonid spawning habitats in the mainstem would also likely protect overwintering fry, juvenile, and egg incubation stages of salmonids, as well as other fisheries and wildlife habitats in the mainstem. However, as noted above, not all ecological functions in the mainstem would be protected by setting a minimum bypass flow equivalent to 325 cfs at the existing USGS gage. For example, periodic higher flows are needed to maintain the river's channel and provide good quality channel substrates, and higher flows may be needed to facilitate upstream migration of adult steelhead and salmon. Nevertheless, periodic higher flows for migration and channel maintenance would likely not be affected by the current pending water right applications, given that the Navarro River is not heavily regulated with a large flood control project and flows much higher than 325 cfs regularly occur in the mainstem Navarro River.

---

[3] Hatfield, T., and J. Bruce. 2000. Predicting salmonid habitat-flow relationships for streams from western North America. N.Am. J. Fish. Mgmt. 20:1005-1015.

[4] Mean annual discharge (MAD) for the Navarro gage for the periods 1950-1980, 1950-1985, 1950-1990, 1950-1995, and 1950-1999 are all between 500 and 525 cfs.

For the above reasons, we suggest that one approach for addressing the potential impacts to the mainstem Navarro River is to condition new water right permits for projects on Navarro River tributaries with a provision that diversions would only occur when stream flow is at or above 325 cfs at the USGS Navarro River gage near Navarro. This recommendation is based on a theoretical relationship between a stream segment's MAD and "optimal" flows for steelhead spawning. Therefore, any permit with this condition should have mechanisms for modifying this term if additional information demonstrates that an alternative minimum flow requirement for the mainstem Navarro River is warranted. In addition to this term related to the Navarro River mainstem, new water right projects for diversions from the tributaries should conform to other recommendations contained in DFG and NOAA Fisheries 2002 stream flow guidelines, including provisions for a separate and independent minimum bypass flow for the stream reach immediately below the point of diversion. The determination of bypass flow requirements for each diversion site will necessitate additional computations of CFII for each project (at the diversion site and at the confluence of intervening higher order tributaries between the project sites and the Navarro River), and possible studies of stream flow needs for stream reaches below the project diversion sites. We also strongly encourage effective and enforceable permit terms for documenting and ensuring compliance with bypass flow requirements, limitations to the season of diversion, and other environmental protection measures stipulated in the water right permit.

This recommendation for a dual bypass flow for new water rights projects is offered as a suggestion for dealing with the issue of cumulative impacts of numerous diversions on mainstem flows during winter. Other approaches include computation of CFIIs for the mainstem and, as necessary, site specific study of stream flow needs to protect salmonids in the mainstem during the winter diversion season.

We appreciate your interest and willingness to proceed with cumulative impact analyses at the upstream points of interest on the various tributaries affected by these projects. If you have questions about this letter, please contact Dr. William Hearn at NOAA Fisheries at (707) 575-6062 or Linda Hanson at DFG at (707) 944-5562.

Sincerely,

COPY – ORIGINAL SIGNED BY
ROBERT W. FLOERKE

Mr. Robert W. Floerke, Regional Manager
Central Coast Region
Department of Fish & Game

Joseph R. Blum
Acting Northern California Supervisor
Habitat Conservation Division

APPENDIX D

BYPASS FLOW CONTROL STRUCTURE-PRELIMINARY DESIGN

Bypass Flow Control Structure Design Considerations

The WAA/CFII (Appendix A) for the project provides hydrologic analysis of annual runoff for the purpose of assessing water availability for diversion and storage on an annual cycle. It determined the drainage area contributing to the reservoir to be 9.3 acres. To develop design criteria and a preliminary design for the bypass structure, additional hydrologic analyses are required. These are summarized below.

Peak Flow Estimates for Design of Control Structure

The control structure to be used to divert flows either to the reservoir or the bypass route must be designed to accommodate peak flow. The design storm chosen for the bypass route is different than that for the reservoir. The bypass route is utilized for runoff during the period from April 1 through December 14, while the reservoir route is utilized during the permitted diversion period December 15 through March 31. The property owner reports that little if any runoff occurs during the bypass period, nevertheless, the bypass control structure must be designed to accommodate flows that could be reasonably expected to occur. To develop design criteria, we used the rational runoff technique to estimate potential peak flow, and then reviewed USGS stream gage records in the area as a supplemental means to evaluate peak flow design criteria.

The rational runoff method is commonly used for the purposes of culvert sizing and design of other runoff control facilities. We used the rational runoff procedure as described in Chapter 4, Erosion & Sediment Control Handbook, Goldman et al. (1986). Rainfall intensity was calculated according to methods described in the NOAA Precipitation Atlas, Vol. XI (1972) and in "Short Duration Rainfall Frequency Relations for California" (Frederick and Miller, 1979). These documents can be reviewed via the internet at http://www.weather.gov/oh/hdsc/currentpf.htm.

Data used to estimate peak runoff were as follows:

A = drainage area = 9.3 acres
C = runoff coefficient = 0.4
Time of concentration for runoff = 15 minutes
2 year-6 hour rainfall depth = 2.1 inches (estimate from map in Precip. Atlas)
2 year-24 hour rainfall depth = 4.4 inches (estimate from map in Precip. Atlas)
2 year-15 minute rainfall depth = 0.32 inches (calculated estimate)
100 year-15 minute rainfall depth = 0.77 inches (calculated estimate)

Rational runoff method peak flow estimates:
2 year peak runoff = 4.7 cfs (Q = C x I x A = 0.4 x 1.27 in/hr x 9.3 ac)
100 year peak runoff = 11.5 cfs (Q = C x I x A = 0.4 x 3.08 in/hr x 9.3 ac)

These peak flow estimates are not seasonally adjusted for likelihood of occurrence during any particular season. The diversion season for this reservoir is intended to span the period of most abundant runoff, and during the bypass season (April 1 through December

14), relatively little runoff typically occurs and the likelihood of a high-magnitude, low-frequency flood (runoff) event is also low. Annual peak flows for two USGS stream gages near the project site were reviewed determine the magnitude and frequency of events likely to occur in the bypass season.

USGS Gage #11468000 Navarro R Nr Navarro CA (303 square mile drainage area), has a period of record from 1951 to the present. The annual peak flow at this gage occurred during the bypass season on one occasion-December 7, 1952. The peak flow was 18,700 cfs, equivalent to 61.7 cfs per square mile of drainage area. The calculated recurrence interval (see attached analysis) for this event is slightly less than 2 yrs (annual probability of exceedance is > 0.5).

USGS Gage #11467880 Navarro R Trib Nr Philo CA (drainage area 0.65 square miles), has a period of record from 1962 to 1974. The annual peak flow at this gage occurred during the bypass season on one occasion-December 4, 1966. The peak flow was 60 cfs, equivalent to 92.3 cfs per square mile of drainage area. The calculated recurrence interval (see attached analysis) for this event is slightly greater than 2 yrs (annual probability of exceedance is > 0.4).

The gage record from the Navarro River tributary provides a documented estimate of peak flow near the project site. The prorated peak flow for the contributing drainage area of the project reservoir and the proposed bypass structure would be about 1.3 cfs (92.3 cfs/sq mi x 0.0145 sq mi).

These data and estimates indicate that during the bypass season, the expected peak runoff would be comparable to a 2 year recurrence interval event. Rational runoff methods based on predicted rainfall intensity predict the 2 year event to generate peak runoff of 4.7 cfs. USGS streamflow records (gage #11467880) indicate that the runoff rate for a 2 year event in this area would be about 1.3 cfs. Hence, the bypass design is appropriately conservative if designed to convey 4.7 cfs.

The peak flow expected during the diversion season according to USGS gage record (#11467880) using area proration is about 4.4 cfs for a 100 year event. The rational runoff method estimated peak flow for the 100 yea event to be about 11.5 cfs, which is an appropriately conservative design criterion for diversion of flow to the reservoir.

Proposed Design Concepts for Diversion Structure

The bypass structure must be able to divert winter baseflow (February median flow or FMF) of 0.012 cfs while allowing higher flow to be diverted to the reservoir, and allowing peak flows during the bypass season to be routed around the reservoir. Conceptual diagrams and design criteria are follow.

A 30 degree v-notch weir 0.22 ft deep with invert elevation 0.2 ft below the invert for the diversion to the reservoir will route bypass flows to a 12 inch diameter flexible plastic pipe with smooth interior walls (pipe size was estimated using proprietary on-line calculators www.lmnoeng.com; see attachments). The v-notch will be set in a 3 ft wide rectangular weir that can accommodate the design peak flow of 4.7 cfs. Weir capacity was determined from tables in ISCO Open Channel Flow Measurement Handbook, 1988, ISCO Inc, Lincoln, NE.

Flow to the reservoir during the diversion season will be routed through a 3 ft wide rectangular weir that is capable of conveying the 11.5 cfs design peak flow. The invert elevation for the rectangular bypass weir should be slightly higher (about 0.02 ft or ¼ inch) than the invert elevation for the diversion weir.

Removable flashboards fit to the rectangular weirs will be used to control flows. During the bypass season (April 1 through December 14), a flashboard will block flow through the rectangular weir to the reservoir. During the diversion season (December 15 through March 31), a flashboard will block flow through the rectangular bypass weir, but the v-notch set in the rectangular bypass weir will remain open.

The bypass structure, particularly the v-notch and flashboards, will need to be routinely maintained to ensure that they function properly and are not obstructed by debris.

Water Resources

National Water Information System: Web Interface

Data Category: Surface Water | Geographic Area: California | GO

Peak Streamflow for California

USGS 11468000 NAVARRO R NR NAVARRO CA

Available data for this site | Surface-water: Peak streamflow | GO

Mendocino County, California
Hydrologic Unit Code 18010108
Latitude 39°10'14", Longitude 123°40'01" NAD27
Drainage area 303 square miles
Gage datum 4.79 feet above sea level NGVD29

Output formats

- Table
- Graph
- Tab-separated file
- WATSTORE formatted file
- Reselect output format

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1938	Dec. 1937	38.20	
1951	Jan. 21, 1951	28.41	20,700
1952	Dec. 27, 1951	27.27	19,400
1953	Dec. 07, 1952	26.64	18,700
1954	Jan. 17, 1954	33.42	30,400
1955	Jan. 19, 1955	12.18	4,340
1956	Dec. 22, 1955	40.60	64,500
1957	Feb. 24, 1957	23.44	14,200
1958	Feb. 24, 1958	34.61	34,100
1959	Feb. 16, 1959	27.57	19,600
1960	Feb. 08, 1960	30.98	24,800
1961	Feb. 11, 1961	18.28	9,510
1962	Feb. 13, 1962	29.00	22,300
1963	Jan. 31, 1963	34.34	33,100
1964	Jan. 20, 1964	25.80	17,900
1965	Dec. 22, 1964	38.64	52,100
1966	Jan. 05, 1966	34.34	33,100
1967	Jan. 21, 1967	24.27	16,100
1968	Jan. 14, 1968	19.90	11,300
1969	Jan. 13, 1969	27.70	20,400
1970	Jan. 24, 1970	33.44	43,900

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1978	Jan. 16, 1978	25.35	22,500
1979	Jan. 11, 1979	17.53	10,400
1980	Jan. 13, 1980	26.83	25,600
1981	Jan. 28, 1981	17.80	10,700
1982	Feb. 16, 1982	29.96	32,900
1983	Jan. 26, 1983	34.63	45,800
1984	Dec. 25, 1983	22.11	16,500
1985	Feb. 08, 1985	19.38	12,500
1986	Feb. 17, 1986	35.69	49,000
1987	Feb. 13, 1987	16.40	9,420
1988	Jan. 04, 1988	19.16	12,300
1989	Mar. 18, 1989	17.98	10,900
1990	Jan. 07, 1990	11.43	4,930
1991	Mar. 04, 1991	18.49	11,500
1992	Feb. 14, 1992	18.34	11,300
1993	Jan. 21, 1993	35.42	48,200
1994	Feb. 17, 1994	15.88	8,370
1995	Jan. 09, 1995	38.49	51,400
1996	Jan. 25, 1996	25.57	16,200
1997	Dec. 31, 1996	35.09	40,600
1998	Feb. 06, 1998	27.97	20,900

18700/303 = 61.7 cfs/mi

1971	Jan. 16, 1971	24.00	20,000	1999	Feb. 09, 1999	25.70	16,400
1972	Dec. 22, 1971	8.08	2,860	2000	Feb. 14, 2000	24.64	14,600
1973	Jan. 16, 1973	23.28	18,700	2001	Mar. 04, 2001	20.51	9,560
1974	Jan. 16, 1974	39.13	61,000	2002	Jan. 02, 2002	20.85	9,890
1975	Mar. 21, 1975	22.88	17,800	2003	Dec. 16, 2002	31.96	30,400
1976	Mar. 01, 1976	7.85	2,790	2004	Feb. 17, 2004	32.51	32,000
1977	Mar. 16, 1977	3.84	630	2005	Mar. 23, 2005	18.14	7,510
				2006	Dec. 31, 2005	39.81	62,000

Peak Streamflow for California

USGS 1146 880 KR TR F PHI

Available data for this site

Program PeakFq U. S. GEOLOGICAL SURVEY Seq.000.000
Ver. 5.0 Beta 8 Annual peak flow frequency analysis Run Date / Time
05/06/2005 following Bulletin 17-B Guidelines 04/24/2007 13:55

--- PROCESSING OPTIONS ---

Plot option = Graphics & Printer
Basin char output = None
Print option = Yes
Debug print = No
Input peaks listing = Long
Input peaks format = WATSTORE peak file

Input files used:
peaks (ascii) - C:\DOCUMENTS AND SETTINGS\ADMINISTRATOR\MY DOCUMENTS\2007 PROJECTS\JENKS\CAE3STC
specifications - PKFQWPSF.TMP
Output file(s):
main - C:\DOCUMENTS AND SETTINGS\ADMINISTRATOR\MY DOCUMENTS\2007 PROJECTS\JENKS\CAE3STC

1
Program PeakFq U. S. GEOLOGICAL SURVEY Seq.001.001
Ver. 5.0 Beta 8 Annual peak flow frequency analysis Run Date / Time
05/06/2005 following Bulletin 17-B Guidelines 04/24/2007 13:55

Station - 11467880 NAVARRO R TRIB NR PHILO CA

INPUT DATA SUMMARY

Number of peaks in record = 10
Peaks not used in analysis = 0
Systematic peaks in analysis = 10
Historic peaks in analysis = 0
Years of historic record = 0
Generalized skew = -0.300
Standard error = 0.550
Mean Square error = 0.303
Skew option = WEIGHTED
Gage base discharge = 0.0
User supplied high outlier threshold = --
User supplied low outlier criterion = --
Plotting position parameter = 0.00

********* NOTICE -- Preliminary machine computations. *********
********* User responsible for assessment and interpretation. *********

WCF134I-NO SYSTEMATIC PEAKS WERE BELOW GAGE BASE. 0.0
WCF198I-LOW OUTLIERS BELOW FLOOD BASE WERE DROPPED. 1
13.0
WCF163I-NO HIGH OUTLIERS OR HISTORIC PEAKS EXCEEDED HHBASE.
146.6

Program PeakFq U. S. GEOLOGICAL SURVEY Seq.001.002
Ver. 5.0 Beta 8 Annual peak flow frequency analysis Run Date / Time
05/06/2005 following Bulletin 17-B Guidelines 04/24/2007 13:55

Station - 11467880 NAVARRO R TRIB NR PHILO CA

ANNUAL FREQUENCY CURVE PARAMETERS -- LOG-PEARSON TYPE III

	FLOOD BASE		LOGARITHMIC		
	DISCHARGE	EXCEEDANCE PROBABILITY	MEAN	STANDARD DEVIATION	SKEW
SYSTEMATIC RECORD	0.0	1.0000	1.7026	0.2887	-1.059
BULL.17B ESTIMATE	13.0	0.9000	1.7400	0.2175	-0.300

ANNUAL FREQUENCY CURVE -- DISCHARGES AT SELECTED EXCEEDANCE PROBABILITIES

ANNUAL EXCEEDANCE PROBABILITY	BULL.17B ESTIMATE	SYSTEMATIC RECORD	'EXPECTED PROBABILITY' ESTIMATE	95-PCT CONFIDENCE LIMITS FOR BULL. 17B ESTIMATES LOWER	UPPER
0.9950	--	4.8	--	--	--
0.9900	--	6.6	--	--	--
0.9500	--	14.4	--	--	--
0.9000	--	20.7	--	--	--
0.8000	36.4	30.6	34.7	24.1	47.5
0.6667	45.2	42.2	44.4	32.5	58.8
0.5000	56.3	56.6	56.3	42.7	75.1
0.4292	61.5	63.0	62.0	47.1	83.7
0.2000	84.2	88.7	87.5	64.4	128.1
0.1000	102.5	105.9	110.3	76.7	171.0
0.0400	125.1	123.0	142.5	90.5	231.6

0.0200	141.6	133.0	169.5	99.9	280.4
0.0100	157.6	141.0	199.7	108.7	331.7
0.0050	173.4	147.5	233.6	117.1	385.5
0.0020	193.9	154.3	285.5	127.6	460.1

1

Program PeakFq U. S. GEOLOGICAL SURVEY Seq.001.003
Ver. 5.0 Beta 8 Annual peak flow frequency analysis Run Date / Time
05/06/2005 following Bulletin 17-B Guidelines 04/24/2007 13:55

Station - 11467880 NAVARRO R TRIB NR PHILO CA

INPUT DATA LISTING

WATER YEAR	DISCHARGE	CODES	WATER YEAR	DISCHARGE	CODES
1962	68.0		1969	71.0	
1965	26.0		1971	39.0	
1966	87.0		1972	12.0	
1967	60.0		1973	58.0	
1968	47.0		1974	127.0	

Explanation of peak discharge qualification codes

PEAKFQ CODE	NWIS CODE	DEFINITION
D	3	Dam failure, non-recurrent flow anomaly
G	8	Discharge greater than stated value
X	3+8	Both of the above
L	4	Discharge less than stated value
K	6 OR C	Known effect of regulation or urbanization
H	7	Historic peak

- Minus-flagged discharge -- Not used in computation
  -8888.0 -- No discharge value given
- Minus-flagged water year -- Historic peak used in computation

Program PeakFq U. S. GEOLOGICAL SURVEY Seq.001.004
Ver. 5.0 Beta 8 Annual peak flow frequency analysis Run Date / Time
05/06/2005 following Bulletin 17-B Guidelines 04/24/2007 13:55

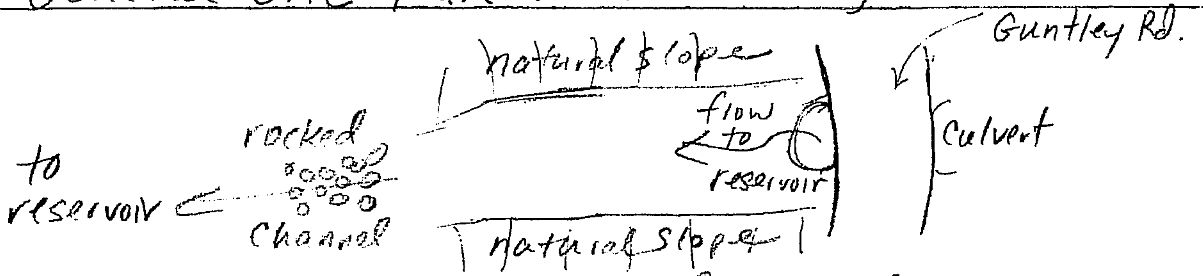
Station - 11467880 NAVARRO R TRIB NR PHILO CA

EMPIRICAL FREQUENCY CURVES -- WEIBULL PLOTTING POSITIONS

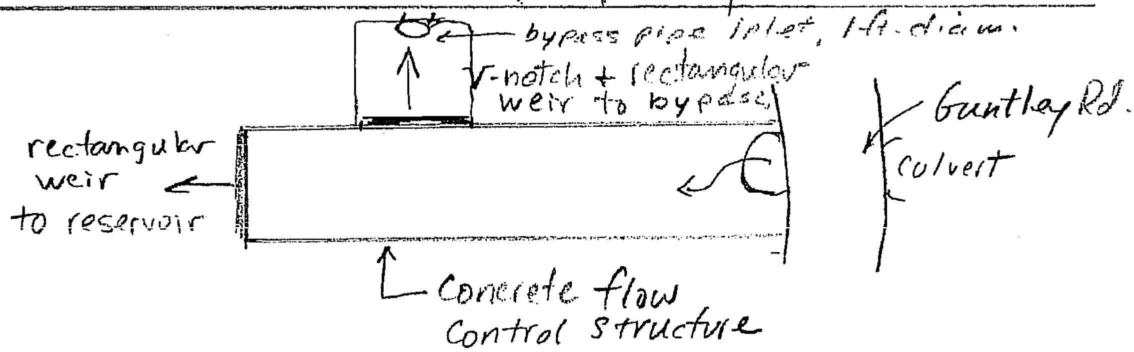
WATER YEAR	RANKED DISCHARGE	SYSTEMATIC RECORD	BULL.17B ESTIMATE
1974	127.0	0.0909	0.0909
1966	87.0	0.1818	0.1818
1969	71.0	0.2727	0.2727
1962	68.0	0.3636	0.3636
1967	60.0	0.4545	0.4545
1973	58.0	0.5455	0.5455
1968	47.0	0.6364	0.6364
1971	39.0	0.7273	0.7273
1965	26.0	0.8182	0.8182
1972	12.0	0.9091	0.9091

Bypass Flow Control Structure Preliminary Design

General Site Plan View (Existing)



General Site Plan View (Proposed)



Control Structure Specifications (Proposed)

Bypass: (1) Median February flow = 0.013 cfs (minimum bypass during diversion season; flow > 0.013 cfs diverted to reservoir)

(2) Bypass up to 0.013 cfs controlled by 30° V-notch 0.2 ft (2.4 in) deep

(3) V-notch invert set 0.2 ft below invert of rectangular weir to reservoir

(4) Rectangular weir for high-range bypass 3 ft wide with V-notch set in base of rectangular weir 1.25 ft high

(5) High-range bypass flows expected to be < 4.7 cfs (2yr-15 minute flow by rational runoff method); USGS Gage #11467880 flood frequency for 100yr recurrence interval by proration of area = 4.4 cfs

Bypass pipe diameter = 1 ft; corrugated plastic, smooth interior wall

Control Structure Specifications (Proposed) Continued

Bypass: (6) During diversion season (Dec. 15 – March 31), flashboard closes upper rectangular weir but maintains opening for v-notch

(7) Bypass pipe diameter = 1 ft; corrugated flexible plastic with smooth interior wall

(8) Entry of bypass flow from weir to pipe enclosed by concrete trough

(9) Rock-lined ditch installed for 10 ft at outlet

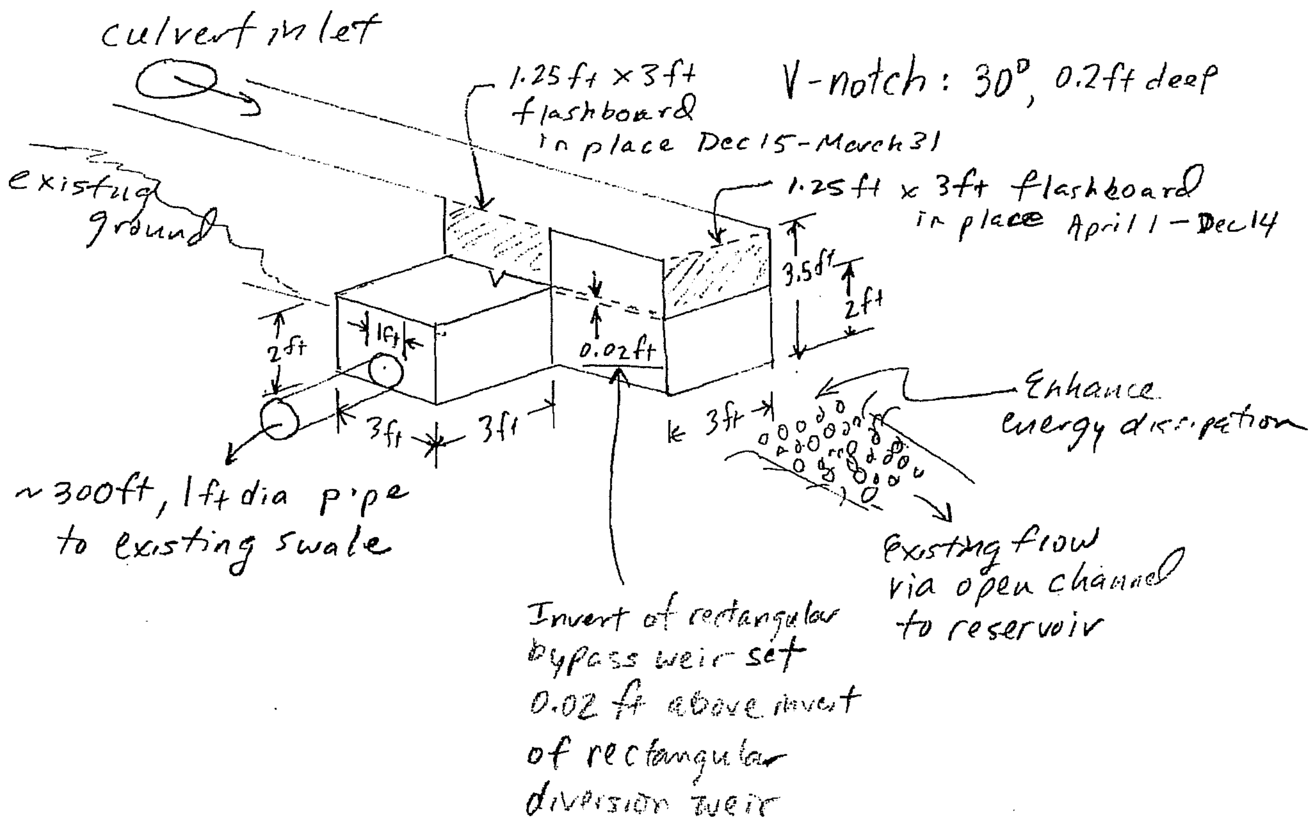
Reservoir: (1) Rectangular weir 3 ft wide with max. depth 1.25 ft (max. discharge = 13.9 cfs)

(2) Invert of rectangular weir 0.2 ft above invert of V-notch for bypass and 0.02 ft below invert of rectangular bypass weir.

(3) Flashboard controls closure of flow to reservoir April 1 through Dec 14

(4) Enhance energy dissipation below structure

Control Structure Design Sketch (Proposed)



Major Loss Calculation for Water in Pipes using Hazen-Williams Friction Loss Equation

Hazen-Williams friction loss equation is valid for water at temperatures typical of city water supply systems (40 to 75 °F; 4 to 25 °C).

To: LMNO Engineering home page Trouble printing?
Design of Circular Water Pipes Calculator Table of Hazen-Williams Coefficients (C) Unit Conversions

$$V = k\,C\,R_h^{0.63}\,S^{0.54} \quad \text{where} \quad S = \frac{h_f}{L} \quad \& \quad Q = VA \quad \& \quad R_h = \frac{D}{4} \text{ for circular pipe}$$

Click to Calculate

Calculate:
- Discharge and Velocity
- Pipe Diameter (Q known) (selected)
- Pipe Diameter (V known)
- Energy (Head) Loss (Q known)
- Energy (Head) Loss (V known)
- Pipe Length (Q known)
- Pipe Length (V known)
- Hazen-Williams Coefficient (Q kno
- Hazen-Williams Coefficient (V kno

Select Units:
- Use feet and seconds units (selected)
- Use meters and seconds units

k = 1.318

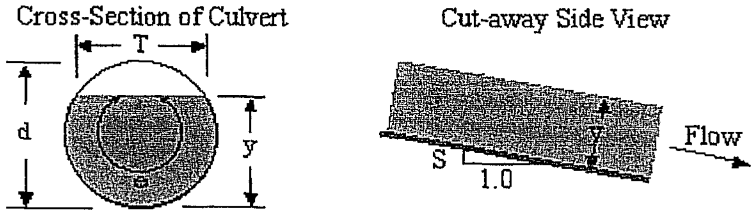
Discharge, Q (ft^3/s):	4.7
Velocity, V (ft/s):	8.379904287876593
Pipe Diameter, D (ft):	0.8450539948176781
Pipe Length, L (ft):	300.0
Hazen Williams Coefficient, C:	140.0
Energy (Head) Loss, hf (ft):	6.0
Energy Slope, S (ft/ft):	0.02

k is a unit conversion factor:
k=1.318 for English units (feet and seconds). k=0.85 for SI units (meters and seconds)
R_h=hydraulic radius=D/4 for circular pipe

The Hazen-Williams method is only valid for water flowing at ordinary temperatures (about 40 to 75 °F). For other liquids or gases, the Darcy-Weisbach method should be used. Major loss (h_f) is the energy (or head) loss (expressed in length units - think of it as energy per unit weight of fluid) due to friction between the moving fluid and the duct. It is also known as friction loss. The Darcy-Weisbach method is generally considered more accurate than the Hazen-Williams method. However, the Hazen-Williams method is very popular, especially among civil engineers, since its friction coefficient (C) is not a function of velocity or duct diameter. Hazen-Williams is simpler than Darcy-Weisbach for calculations where you are solving for flowrate, velocity, or diameter. More Discussion and References.

Circular Culvert using Manning Equation	Uses Manning equation with circular culvert geometry. Compute velocity, discharge, depth, top width, culvert diameter, area, wetted perimeter, hydraulic radius, Froude number, Manning coefficient, channel slope.

To: LMNO Engineering home page (more calculations)
Culvert Design using Inlet and Outlet Control Trapezoidal Channel Design Rectangular Channels
Unit Conversions
LMNO@LMNOeng.com phone (USA): (740) 592-1890 Trouble printing?



$$Q = VA \qquad V = \frac{k}{n} R^{2/3} S^{1/2} \qquad R = \frac{A}{P} \qquad A = \frac{d^2}{8}(\theta - \sin(\theta))$$

$$P = \frac{\theta d}{2} \qquad y = \frac{d}{2}\left[1 - \cos\left(\frac{\theta}{2}\right)\right] \qquad T = 2\sqrt{y(d-y)} \qquad F = V\sqrt{\frac{T}{gA\cos(Tan^{-1}S)}}$$

Register to enable "Calculate" button.

All features enabled	Discharge, Q (cfs):	4.924762191080749
Click to Calculate	Velocity, V (ft/s):	7.311386079400167
	Water Depth, y (ft):	0.8
Enter n, S, d, y	Culvert Diameter, d (inch):	12.0
http://www.LMNOeng.com	Ratio y/d:	0.8000000000000002
Discharge in ft³/s or cfs	Top Width, T (ft):	0.7999999999999995
Velocity in ft/s	Manning Roughness, n:	0.013
Depth in ft	Channel Slope, S (m/m):	0.02
Diameter in inch	Area, A (ft²):	0.6735743568970453
Top width in ft	Wetted Perimeter, P (ft):	2.214297435881813
A in ft². P, R in ft	Hydraulic Radius, R (ft):	0.304193261515531
© 1998-2000 LMNO Engineering,	Angle, theta (degrees):	253.7397952916813
Research, and Software, Ltd.	Froude Number, F:	1.404894166729448З

Links on this page: Introduction Variables Manning's n coefficients Error messages References

Introduction

The equation beginning V=.... is called the Manning Equation. It is a semi-empirical equation and is the most commonly used equation for uniform steady state flow of water in open channels (see Discussion and References for Open Channel Flow for further discussion). Because it is empirical, the Manning equation has inconsistent units which are handled through the conversion factor k. Uniform means that the water surface has the same slope as the channel bottom. Uniform flow is actually only achieved in channels that are long and have an unchanging cross-section. However, the Manning equation is used in

TABLE 6-1B

DISCHARGE OF 30° V-NOTCH WEIR

FORMULAS: $CFS = 0.676\,H^{2.5}$ GS = CFS X 7.481 MGD = CFS X 0.6463

HEAD FT.	CFS	GS	MGD	HEAD FT.	CFS	GS	MGD	HEAD FT.	CFS	GS	MGD	HEAD FT.	CFS	GS	MGD	HEAD FT.	CFS	GS	MGD
0.01	.0000	.0001	.0000	0.26	.0233	.1743	.0151	0.51	.1256	.9394	.0812	0.76	.3404	2.546	.2200	1.01	.6930	5.185	.4479
0.02	.0000	.0003	.0000	0.27	.0256	.1916	.0165	0.52	.1318	.9861	.0852	0.77	.3517	2.631	.2273	1.02	.7103	5.314	.4591
0.03	.0001	.0008	.0001	0.28	.0280	.2098	.0181	0.53	.1382	1.034	.0893	0.78	.3632	2.717	.2348	1.03	.7278	5.445	.4704
0.04	.0002	.0016	.0001	0.29	.0306	.2290	.0198	0.54	.1449	1.084	.0936	0.79	.3750	2.805	.2424	1.04	.7456	5.578	.4819
0.05	.0004	.0028	.0002	0.30	.0333	.2493	.0215	0.55	.1517	1.135	.0980	0.80	.3870	2.895	.2501	1.05	.7637	5.713	.4936
0.06	.0006	.0045	.0004	0.31	.0362	.2706	.0234	0.56	.1586	1.187	.1025	0.81	.3992	2.986	.2580	1.06	.7820	5.850	.5054
0.07	.0009	.0066	.0006	0.32	.0392	.2929	.0253	0.57	.1658	1.240	.1072	0.82	.4116	3.079	.2660	1.07	.8006	5.989	.5174
0.08	.0012	.0092	.0008	0.33	.0423	.3164	.0273	0.58	.1732	1.296	.1119	0.83	.4243	3.174	.2742	1.08	.8194	6.130	.5296
0.09	.0016	.0123	.0011	0.34	.0456	.3409	.0294	0.59	.1807	1.352	.1168	0.84	.4372	3.270	.2825	1.09	.8385	6.273	.5419
0.10	.0021	.0160	.0014	0.35	.0490	.3665	.0317	0.60	.1885	1.410	.1218	0.85	.4503	3.369	.2910	1.10	.8579	6.418	.5544
0.11	.0027	.0203	.0018	0.36	.0526	.3932	.0340	0.61	.1965	1.470	.1270	0.86	.4637	3.469	.2997	1.11	.8775	6.565	.5671
0.12	.0034	.0252	.0022	0.37	.0563	.4211	.0364	0.62	.2046	1.531	.1322	0.87	.4772	3.570	.3084	1.12	.8974	6.714	.5800
0.13	.0041	.0308	.0027	0.38	.0602	.4502	.0389	0.63	.2130	1.593	.1376	0.88	.4911	3.674	.3174	1.13	.9176	6.864	.5930
0.14	.0050	.0371	.0032	0.39	.0642	.4804	.0415	0.64	.2215	1.657	.1432	0.89	.5052	3.779	.3265	1.14	.9380	7.017	.6062
0.15	.0059	.0441	.0038	0.40	.0684	.5117	.0442	0.65	.2303	1.723	.1488	0.90	.5195	3.886	.3357	1.15	.9587	7.172	.6196
0.16	.0069	.0518	.0045	0.41	.0728	.5443	.0470	0.66	.2392	1.790	.1546	0.91	.5340	3.995	.3451	1.16	.9797	7.329	.6332
0.17	.0081	.0603	.0052	0.42	.0773	.5781	.0499	0.67	.2484	1.858	.1605	0.92	.5488	4.106	.3547	1.17	1.001	7.488	.6469
0.18	.0093	.0695	.0060	0.43	.0820	.6132	.0530	0.68	.2578	1.928	.1666	0.93	.5638	4.218	.3644	1.18	1.022	7.649	.6608
0.19	.0106	.0796	.0069	0.44	.0868	.6494	.0561	0.69	.2673	2.000	.1728	0.94	.5791	4.332	.3743	1.19	1.044	7.812	.6749
0.20	.0121	.0905	.0078	0.45	.0918	.6870	.0593	0.70	.2771	2.073	.1791	0.95	.5946	4.449	.3843	1.20	1.066	7.977	.6892
0.21	.0137	.1022	.0088	0.46	.0970	.7258	.0627	0.71	.2871	2.148	.1856	0.96	.6104	4.567	.3945	1.21	1.089	8.145	.7036
0.22	.0153	.1148	.0099	0.47	.1024	.7659	.0662	0.72	.2974	2.225	.1922	0.97	.6264	4.686	.4049	1.22	1.111	8.314	.7183
0.23	.0172	.1283	.0111	0.48	.1079	.8073	.0697	0.73	.3078	2.303	.1989	0.98	.6427	4.808	.4154	1.23	1.134	8.485	.7331
0.24	.0191	.1427	.0123	0.49	.1136	.8500	.0734	0.74	.3184	2.382	.2058	0.99	.6592	4.932	.4261	1.24	1.157	8.659	.7481
0.25	.0211	.1580	.0137	0.50	.1195	.8940	.0772	0.75	.3293	2.464	.2128	1.00	.6760	5.057	.4369	1.25	1.181	8.834	.7632

DISCHARGE OF 30° V-NOTCH WEIR

TABLE 6-1B CONTINUED

HEAD FT.	CFS	GS	MGD	HEAD FT.	CFS	GS	MGD	HEAD FT.	CES	GS	MGD	HEAD FT.	CFS	GS	MGD	HEAD FT.	CFS	GS	MGD
1.26	1.205	9.012	.7786	1.61	2.223	16.63	1.437	1.96	3.636	27.20	2.350	2.31	5.482	41.01	3.543	2.66	7.801	58.36	5.042
1.27	1.229	9.192	.7941	1.62	2.258	16.89	1.459	1.97	3.682	27.55	2.380	2.32	5.542	41.46	3.582	2.67	7.875	58.91	5.089
1.28	1.253	9.374	.8099	1.63	2.293	17.15	1.482	1.98	3.729	27.90	2.410	2.33	5.602	41.91	3.621	2.68	7.948	59.46	5.137
1.29	1.278	9.558	.8258	1.64	2.328	17.42	1.505	1.99	3.776	28.25	2.441	2.34	5.662	42.36	3.659	2.69	8.023	60.02	5.185
1.30	1.303	9.745	.8419	1.65	2.364	17.69	1.528	2.00	3.824	28.61	2.471	2.35	5.723	42.81	3.699	2.70	8.098	60.58	5.233
1.31	1.328	9.933	.8581	1.66	2.400	17.95	1.551	2.01	3.872	28.97	2.502	2.36	5.784	43.27	3.738	2.71	8.173	61.14	5.282
1.32	1.353	10.12	.8746	1.67	2.436	18.23	1.575	2.02	3.920	29.33	2.534	2.37	5.845	43.73	3.778	2.72	8.248	61.71	5.331
1.33	1.379	10.32	.8913	1.68	2.473	18.50	1.598	2.03	3.969	29.69	2.565	2.38	5.907	44.19	3.818	2.73	8.324	62.27	5.380
1.34	1.405	10.51	.9081	1.69	2.510	18.78	1.622	2.04	4.018	30.06	2.597	2.39	5.970	44.66	3.858	2.74	8.401	62.85	5.429
1.35	1.431	10.71	.9252	1.70	2.547	19.06	1.646	2.05	4.068	30.43	2.629	2.40	6.032	45.13	3.899	2.75	8.478	63.42	5.479
1.36	1.458	10.91	.9424	1.71	2.585	19.34	1.671	2.06	4.117	30.80	2.661	2.41	6.095	45.60	3.939	2.76	8.555	64.00	5.529
1.37	1.485	11.11	.9598	1.72	2.623	19.62	1.695	2.07	4.167	31.18	2.693	2.42	6.159	46.07	3.980	2.77	8.633	64.58	5.579
1.38	1.512	11.31	.9774	1.73	2.661	19.91	1.720	2.08	4.218	31.55	2.726	2.43	6.222	46.55	4.022	2.78	8.711	65.17	5.630
1.39	1.540	11.52	.9952	1.74	2.700	20.20	1.745	2.09	4.269	31.94	2.759	2.44	6.287	47.03	4.063	2.79	8.789	65.75	5.681
1.40	1.568	11.73	1.013	1.75	2.739	20.49	1.770	2.10	4.320	32.32	2.792	2.45	6.351	47.51	4.105	2.80	8.868	66.34	5.732
1.41	1.596	11.94	1.031	1.76	2.778	20.78	1.795	2.11	4.372	32.70	2.825	2.46	6.416	48.00	4.147	2.81	8.948	66.94	5.783
1.42	1.624	12.15	1.050	1.77	2.818	21.08	1.821	2.12	4.424	33.09	2.859	2.47	6.482	48.49	4.189	2.82	9.028	67.53	5.834
1.43	1.653	12.37	1.068	1.78	2.858	21.38	1.847	2.13	4.476	33.49	2.893	2.48	6.548	48.98	4.232	2.83	9.108	68.14	5.886
1.44	1.682	12.58	1.087	1.79	2.898	21.68	1.873	2.14	4.529	33.88	2.927	2.49	6.614	49.48	4.274	2.84	9.188	68.74	5.938
1.45	1.711	12.80	1.106	1.80	2.939	21.98	1.899	2.15	4.582	34.28	2.961	2.50	6.680	49.98	4.317	2.85	9.270	69.35	5.991
1.46	1.741	13.03	1.125	1.81	2.979	22.29	1.926	2.16	4.635	34.68	2.996	2.51	6.747	50.48	4.361	2.86	9.351	69.96	6.044
1.47	1.771	13.25	1.145	1.82	3.021	22.60	1.952	2.17	4.689	35.08	3.031	2.52	6.815	50.98	4.404	2.87	9.433	70.57	6.097
1.48	1.801	13.48	1.164	1.83	3.062	22.91	1.979	2.18	4.743	35.49	3.066	2.53	6.883	51.49	4.448	2.88	9.515	71.18	6.150
1.49	1.832	13.70	1.184	1.84	3.104	23.22	2.006	2.19	4.798	35.89	3.101	2.54	6.951	52.00	4.492	2.89	9.598	71.80	6.203
1.50	1.863	13.94	1.204	1.85	3.147	23.54	2.034	2.20	4.853	36.30	3.136	2.55	7.019	52.51	4.537	2.90	9.681	72.43	6.257
1.51	1.894	14.17	1.224	1.86	3.190	23.86	2.061	2.21	4.908	36.72	3.172	2.56	7.088	53.03	4.581	2.91	9.765	73.05	6.311
1.52	1.926	14.41	1.244	1.87	3.233	24.18	2.089	2.22	4.964	37.14	3.208	2.57	7.158	53.55	4.626	2.92	9.849	73.68	6.366
1.53	1.957	14.64	1.265	1.88	3.276	24.51	2.117	2.23	5.020	37.56	3.244	2.58	7.228	54.07	4.671	2.93	9.934	74.31	6.420
1.54	1.990	14.88	1.286	1.89	3.320	24.83	2.146	2.24	5.077	37.98	3.281	2.59	7.298	54.60	4.717	2.94	10.02	74.95	6.475
1.55	2.022	15.13	1.307	1.90	3.364	25.16	2.174	2.25	5.133	38.40	3.318	2.60	7.369	55.12	4.762	2.95	10.10	75.59	6.530
1.56	2.055	15.37	1.328	1.91	3.408	25.50	2.203	2.26	5.191	38.83	3.355	2.61	7.440	55.66	4.808	2.96	10.19	76.23	6.586
1.57	2.088	15.62	1.349	1.92	3.453	25.83	2.232	2.27	5.248	39.26	3.392	2.62	7.511	56.19	4.854	2.97	10.28	76.88	6.642
1.58	2.121	15.87	1.371	1.93	3.498	26.17	2.261	2.28	5.306	39.70	3.429	2.63	7.583	56.73	4.901	2.98	10.36	77.53	6.698
1.59	2.155	16.12	1.393	1.94	3.544	26.51	2.290	2.29	5.365	40.13	3.467	2.64	7.655	57.27	4.948	2.99	10.45	78.18	6.754
1.60	2.189	16.38	1.415	1.95	3.589	26.85	2.320	2.30	5.423	40.57	3.505	2.65	7.728	57.81	4.995	3.00	10.54	78.83	6.811

TABLE 6-3A

DISCHARGE OF 1', 1.5', 2', 2.5', & 3' RECTANGULAR WEIRS WITHOUT END CONTRACTIONS

FORMULAS: $CFS = 3.33LH^{1.5}$ $GS = CFS \times 7.481$ $MGD = CFS \times 0.6463$

HEAD	1.0 FT.			1.5 FT.			2.0 FT.			2.5 FT.			3.0 FT.		
FT.	CFS	GS	MGD	CFS	GS	MGD	CFS	GS	MGD	CFS	GS	MGD	CFS	GS	MGD
0.01	.0033	.0249	.0022	.0050	.0374	.0032	.0067	.0498	.0043	.0083	.0623	.0054	.0100	.0747	.0065
0.02	.0094	.0705	.0061	.0141	.1057	.0091	.0188	.1409	.0122	.0235	.1762	.0152	.0283	.2114	.0183
0.03	.0173	.1294	.0112	.0260	.1942	.0168	.0346	.2589	.0224	.0433	.3236	.0280	.0519	.3883	.0335
0.04	.0266	.1993	.0172	.0400	.2989	.0258	.0533	.3986	.0344	.0666	.4982	.0430	.0799	.5979	.0517
0.05	.0372	.2785	.0241	.0558	.4178	.0361	.0745	.5570	.0481	.0931	.6963	.0602	.1117	.8356	.0722
0.06	.0489	.3661	.0316	.0734	.5492	.0474	.0979	.7323	.0633	.1224	.9153	.0791	.1468	1.098	.0949
0.07	.0617	.4614	.0399	.0925	.6921	.0598	.1233	.9227	.0797	.1542	1.153	.0996	.1850	1.384	.1196
0.08	.0753	.5637	.0487	.1130	.8455	.0730	.1507	1.127	.0974	.1884	1.409	.1217	.2260	1.691	.1461
0.09	.0899	.6726	.0581	.1349	1.009	.0872	.1798	1.345	.1162	.2248	1.682	.1453	.2697	2.018	.1743
0.10	.1053	.7878	.0681	.1580	1.182	.1021	.2106	1.576	.1361	.2633	1.969	.1701	.3159	2.363	.2042
0.11	.1215	.9089	.0785	.1822	1.363	.1178	.2430	1.818	.1570	.3037	2.272	.1963	.3645	2.727	.2356
0.12	.1384	1.036	.0895	.2076	1.553	.1342	.2769	2.071	.1789	.3461	2.589	.2237	.4153	3.107	.2684
0.13	.1561	1.168	.1009	.2341	1.752	.1513	.3122	2.335	.2018	.3902	2.919	.2522	.4683	3.503	.3026
0.14	.1744	1.305	.1127	.2617	1.957	.1691	.3489	2.610	.2255	.4361	3.262	.2818	.5233	3.915	.3382
0.15	.1935	1.447	.1250	.2902	2.171	.1875	.3869	2.894	.2501	.4836	3.618	.3126	.5804	4.342	.3751
0.16	.2131	1.594	.1377	.3197	2.392	.2066	.4262	3.189	.2755	.5328	3.986	.3443	.6394	4.783	.4132
0.17	.2334	1.746	.1509	.3501	2.619	.2263	.4668	3.492	.3017	.5835	4.365	.3771	.7002	5.238	.4526
0.18	.2543	1.902	.1644	.3815	2.854	.2465	.5086	3.805	.3287	.6358	4.756	.4109	.7629	5.707	.4931
0.19	.2758	2.063	.1782	.4137	3.095	.2674	.5516	4.126	.3565	.6895	5.158	.4456	.8274	6.190	.5347
0.20	.2978	2.228	.1925	.4468	3.342	.2887	.5957	4.456	.3850	.7446	5.570	.4812	.8935	6.685	.5775
0.21	.3205	2.397	.2071	.4807	3.596	.3107	.6409	4.795	.4142	.8011	5.993	.5178	.9614	7.192	.6213
0.22	.3436	2.571	.2221	.5154	3.856	.3331	.6872	5.141	.4442	.8590	6.427	.5552	1.031	7.712	.6662
0.23	.3673	2.748	.2374	.5510	4.122	.3561	.7346	5.496	.4748	.9183	6.870	.5935	1.102	8.244	.7122
0.24	.3915	2.929	.2530	.5873	4.394	.3796	.7831	5.858	.5061	.9788	7.323	.6326	1.175	8.787	.7591
0.25	.4163	3.114	.2690	.6244	4.671	.4035	.8325	6.228	.5380	1.041	7.785	.6726	1.249	9.342	.8071

DISCHARGE OF 1', 1.5', 2', 2.5', & 3' RECTANGULAR WEIRS WITHOUT END CONTRACTIONS

TABLE 6-3A CONTINUED

HEAD	1.0 FT.			1.5 FT.			2.0 FT.			2.5 FT.			3.0 FT.		
FT.	CFS	GS	MGD	CFS	GS	MGD	CFS	GS	MGD	CFS	GS	MGD	CFS	GS	MGD
0.26	.4415	3.303	.2853	.6622	4.954	.4280	.8829	6.605	.5706	1.104	8.257	.7133	1.324	9.908	.8560
0.27	.4672	3.495	.3019	.7008	5.243	.4529	.9344	6.990	.6039	1.168	8.738	.7549	1.402	10.49	.9058
0.28	.4934	3.691	.3189	.7401	5.536	.4783	.9868	7.382	.6377	1.233	9.227	.7972	1.480	11.07	.9566
0.29	.5200	3.890	.3361	.7801	5.836	.5042	1.040	7.781	.6722	1.300	9.726	.8403	1.560	11.67	1.008
0.30	.5472	4.093	.3536	.8208	6.140	.5305	1.094	8.187	.7073	1.368	10.23	.8841	1.642	12.28	1.061
0.31	.5748	4.300	.3715	.8621	6.450	.5572	1.150	8.600	.7429	1.437	10.75	.9287	1.724	12.90	1.114
0.32	.6028	4.510	.3896	.9042	6.764	.5844	1.206	9.019	.7792	1.507	11.27	.9740	1.808	13.53	1.169
0.33	.6313	4.723	.4080	.9469	7.084	.6120	1.263	9.445	.8160	1.578	11.81	1.020	1.894	14.17	1.224
0.34	.6602	4.939	.4267	.9903	7.408	.6400	1.320	9.878	.8533	1.650	12.35	1.067	1.981	14.82	1.280
0.35	.6895	5.158	.4456	1.034	7.737	.6685	1.379	10.32	.8913	1.724	12.90	1.114	2.069	15.47	1.337
0.36	.7193	5.381	.4649	1.079	8.071	.6973	1.439	10.76	.9297	1.798	13.45	1.162	2.158	16.14	1.395
0.37	.7495	5.607	.4844	1.124	8.410	.7266	1.499	11.21	.9687	1.874	14.02	1.211	2.248	16.82	1.453
0.38	.7800	5.836	.5041	1.170	8.753	.7562	1.560	11.67	1.008	1.950	14.59	1.260	2.340	17.51	1.512
0.39	.8110	6.067	.5242	1.217	9.101	.7863	1.622	12.13	1.048	2.028	15.17	1.310	2.433	18.20	1.573
0.40	.8424	6.302	.5445	1.264	9.453	.8167	1.685	12.60	1.089	2.106	15.76	1.361	2.527	18.91	1.633
0.41	.8742	6.540	.5650	1.311	9.810	.8475	1.748	13.08	1.130	2.186	16.35	1.413	2.623	19.62	1.695
0.42	.9064	6.781	.5858	1.360	10.17	.8787	1.813	13.56	1.172	2.266	16.95	1.465	2.719	20.34	1.757
0.43	.9390	7.024	.6068	1.408	10.54	.9103	1.878	14.05	1.214	2.347	17.56	1.517	2.817	21.07	1.821
0.44	.9719	7.271	.6281	1.458	10.91	.9422	1.944	14.54	1.256	2.430	18.18	1.570	2.916	21.81	1.884
0.45	1.005	7.520	.6497	1.508	11.28	.9745	2.010	15.04	1.299	2.513	18.80	1.624	3.016	22.56	1.949
0.46	1.039	7.772	.6715	1.558	11.66	1.007	2.078	15.54	1.343	2.597	19.43	1.679	3.117	23.32	2.014
0.47	1.073	8.027	.6935	1.609	12.04	1.040	2.146	16.05	1.387	2.682	20.07	1.734	3.219	24.08	2.080
0.48	1.107	8.284	.7157	1.661	12.43	1.074	2.215	16.57	1.431	2.769	20.71	1.789	3.322	24.85	2.147
0.49	1.142	8.545	.7382	1.713	12.82	1.107	2.284	17.09	1.476	2.855	21.36	1.845	3.427	25.63	2.215
0.50	1.177	8.808	.7609	1.766	13.21	1.141	2.355	17.62	1.522	2.943	22.02	1.902	3.532	26.42	2.283
0.51	1.213	9.073	.7839	1.819	13.61	1.176	2.426	18.15	1.568	3.032	22.68	1.960	3.638	27.22	2.352
0.52	1.249	9.341	.8070	1.873	14.01	1.211	2.497	18.68	1.614	3.122	23.35	2.018	3.746	28.02	2.421
0.53	1.285	9.612	.8304	1.927	14.42	1.246	2.570	19.22	1.661	3.212	24.03	2.076	3.855	28.84	2.491
0.54	1.321	9.885	.8540	1.982	14.83	1.281	2.643	19.77	1.708	3.304	24.71	2.135	3.964	29.66	2.562
0.55	1.358	10.16	.8779	2.037	15.24	1.317	2.717	20.32	1.756	3.396	25.40	2.195	4.075	30.48	2.634
0.56	1.395	10.44	.9019	2.093	15.66	1.353	2.791	20.88	1.804	3.489	26.10	2.255	4.186	31.32	2.706
0.57	1.433	10.72	.9262	2.150	16.08	1.389	2.866	21.44	1.852	3.583	26.80	2.315	4.299	32.16	2.779
0.58	1.471	11.00	.9506	2.206	16.51	1.426	2.942	22.01	1.901	3.677	27.51	2.377	4.413	33.01	2.852
0.59	1.509	11.29	.9753	2.264	16.93	1.463	3.018	22.58	1.951	3.773	28.22	2.438	4.527	33.87	2.926
0.60	1.548	11.58	1.000	2.321	17.37	1.500	3.095	23.16	2.000	3.869	28.94	2.501	4.643	34.73	3.001

DISCHARGE OF 1', 1.5', 2', 2.5', & 3' RECTANGULAR WEIRS

WITHOUT END CONTRACTIONS

TABLE 6-3A CONTINUED

HEAD FT.	1.0 FT.			1.5 FT.			2.0 FT.			2.5 FT.			3.0 FT.		
	CFS	GS	MGD	CFS	GS	MGD	CFS	GS	MGD	CFS	GS	MGD	CFS	GS	MGD
0.61	1.586	11.87	1.025	2.380	17.80	1.538	3.173	23.74	2.051	3.966	29.67	2.563	4.759	35.61	3.076
0.62	1.626	12.16	1.051	2.439	18.24	1.576	3.251	24.32	2.101	4.064	30.40	2.627	4.877	36.48	3.152
0.63	1.665	12.46	1.076	2.498	18.69	1.614	3.330	24.91	2.152	4.163	31.14	2.690	4.995	37.37	3.229
0.64	1.705	12.75	1.102	2.557	19.13	1.653	3.410	25.51	2.204	4.262	31.89	2.755	5.115	38.26	3.306
0.65	1.745	13.05	1.128	2.618	19.58	1.692	3.490	26.11	2.256	4.363	32.64	2.820	5.235	39.16	3.384
0.66	1.786	13.36	1.154	2.678	20.04	1.731	3.571	26.71	2.308	4.464	33.39	2.885	5.357	40.07	3.462
0.67	1.826	13.66	1.180	2.739	20.49	1.770	3.652	27.32	2.361	4.566	34.16	2.951	5.479	40.99	3.541
0.68	1.867	13.97	1.207	2.801	20.95	1.810	3.735	27.94	2.414	4.668	34.92	3.017	5.602	41.91	3.620
0.69	1.909	14.28	1.234	2.863	21.42	1.850	3.817	28.56	2.467	4.772	35.70	3.084	5.726	42.83	3.701
0.70	1.950	14.59	1.260	2.925	21.88	1.891	3.901	29.18	2.521	4.876	36.47	3.151	5.851	43.77	3.781
0.71	1.992	14.90	1.288	2.988	22.36	1.931	3.984	29.81	2.575	4.980	37.26	3.219	5.977	44.71	3.863
0.72	2.034	15.22	1.315	3.052	22.83	1.972	4.069	30.44	2.630	5.086	38.05	3.287	6.103	45.66	3.945
0.73	2.077	15.54	1.342	3.115	23.31	2.014	4.154	31.08	2.685	5.192	38.84	3.356	6.231	46.61	4.027
0.74	2.120	15.86	1.370	3.180	23.79	2.055	4.240	31.72	2.740	5.299	39.65	3.425	6.359	47.57	4.110
0.75	2.163	16.18	1.398	3.244	24.27	2.097	4.326	32.36	2.796	5.407	40.45	3.495	6.489	48.54	4.194
0.76	2.206	16.51	1.426	3.309	24.76	2.139	4.413	33.01	2.852	5.516	41.26	3.565	6.619	49.52	4.278
0.77	2.250	16.83	1.454	3.375	25.25	2.181	4.500	33.66	2.908	5.625	42.08	3.635	6.750	50.50	4.363
0.78	2.294	17.16	1.483	3.441	25.74	2.224	4.588	34.32	2.965	5.735	42.90	3.706	6.882	51.48	4.448
0.79	2.338	17.49	1.511	3.507	26.24	2.267	4.676	34.98	3.022	5.846	43.73	3.778	7.015	52.48	4.534
0.80	2.383	17.83	1.540	3.574	26.74	2.310	4.766	35.65	3.080	5.957	44.56	3.850	7.148	53.48	4.620
0.81	2.428	18.16	1.569	3.641	27.24	2.353	4.855	36.32	3.138	6.069	45.40	3.922	7.283	54.48	4.707
0.82	2.473	18.50	1.598	3.709	27.75	2.397	4.945	37.00	3.196	6.182	46.24	3.995	7.418	55.49	4.794
0.83	2.518	18.84	1.627	3.777	28.26	2.441	5.036	37.67	3.255	6.295	47.09	4.069	7.554	56.51	4.882
0.84	2.564	19.18	1.657	3.846	28.77	2.485	5.127	38.36	3.314	6.409	47.95	4.142	7.691	57.54	4.971
0.85	2.610	19.52	1.687	3.914	29.28	2.530	5.219	39.04	3.373	6.524	48.81	4.216	7.829	58.57	5.060
0.86	2.656	19.87	1.716	3.984	29.80	2.575	5.312	39.74	3.433	6.639	49.67	4.291	7.967	59.60	5.149
0.87	2.702	20.22	1.746	4.053	30.32	2.620	5.404	40.43	3.493	6.756	50.54	4.366	8.107	60.65	5.239
0.88	2.749	20.56	1.777	4.123	30.85	2.665	5.498	41.13	3.553	6.872	51.41	4.442	8.247	61.69	5.330
0.89	2.796	20.92	1.807	4.194	31.37	2.711	5.592	41.83	3.614	6.990	52.29	4.518	8.388	62.75	5.421
0.90	2.843	21.27	1.838	4.265	31.90	2.756	5.686	42.54	3.675	7.108	53.18	4.594	8.530	63.81	5.513
0.91	2.891	21.63	1.868	4.336	32.44	2.802	5.781	43.25	3.737	7.227	54.06	4.671	8.672	64.88	5.605
0.92	2.939	21.98	1.899	4.408	32.97	2.849	5.877	43.97	3.798	7.346	54.96	4.748	8.816	65.95	5.697
0.93	2.987	22.34	1.930	4.480	33.51	2.895	5.973	44.68	3.860	7.466	55.86	4.826	8.960	67.03	5.791
0.94	3.035	22.70	1.961	4.552	34.06	2.942	6.070	45.41	3.923	7.587	56.76	4.904	9.105	68.11	5.884
0.95	3.083	23.07	1.993	4.625	34.60	2.989	6.167	46.13	3.986	7.708	57.67	4.982	9.250	69.20	5.978

DISCHARGE OF 1', 1.5', 2', 2.5', & 3' RECTANGULAR WEIRS

WITHOUT END CONTRACTIONS

TABLE 6-3A CONTINUED

HEAD FT.	1.0 FT.			1.5 FT.			2.0 FT.			2.5 FT.			3.0 FT.		
	CFS	GS	MGD	CFS	GS	MGD	CFS	GS	MGD	CFS	GS	MGD	CFS	GS	MGD
0.96	3.132	23.43	2.024	4.698	35.15	3.037	6.264	46.86	4.049	7.831	58.58	5.061	9.397	70.30	6.073
0.97	3.181	23.80	2.056	4.772	35.70	3.084	6.363	47.60	4.112	7.953	59.50	5.140	9.544	71.40	6.168
0.98	3.231	24.17	2.088	4.846	36.25	3.132	6.461	48.34	4.176	8.077	60.42	5.220	9.692	72.50	6.264
0.99	3.280	24.54	2.120	4.920	36.81	3.180	6.560	49.08	4.240	8.200	61.35	5.300	9.841	73.62	6.360
1.00	3.330	24.91	2.152	4.995	37.37	3.228	6.660	49.82	4.304	8.325	62.28	5.380	9.990	74.74	6.457
1.01	3.380	25.29	2.185	5.070	37.93	3.277	6.760	50.57	4.369	8.450	63.22	5.461	10.14	75.86	6.554
1.02	3.430	25.66	2.217	5.146	38.49	3.326	6.861	51.33	4.434	8.576	64.16	5.543	10.29	76.99	6.651
1.03	3.481	26.04	2.250	5.221	39.06	3.375	6.962	52.08	4.499	8.702	65.10	5.624	10.44	78.12	6.749
1.04	3.532	26.42	2.283	5.298	39.63	3.424	7.064	52.84	4.565	8.829	66.05	5.706	10.60	79.26	6.848
1.05	3.583	26.80	2.316	5.374	40.20	3.473	7.166	53.61	4.631	8.957	67.01	5.789	10.75	80.41	6.947
1.06	3.634	27.19	2.349	5.451	40.78	3.523	7.268	54.37	4.698	9.085	67.97	5.872	10.90	81.56	7.046
1.07	3.686	27.57	2.382	5.529	41.36	3.573	7.371	55.15	4.764	9.214	68.93	5.955	11.06	82.72	7.146
1.08	3.737	27.96	2.416	5.606	41.94	3.623	7.475	55.92	4.831	9.344	69.90	6.039	11.21	83.88	7.247
1.09	3.790	28.35	2.449	5.684	42.52	3.674	7.579	56.70	4.898	9.474	70.87	6.123	11.37	85.05	7.347
1.10	3.842	28.74	2.483	5.763	43.11	3.724	7.684	57.48	4.966	9.604	71.85	6.207	11.53	86.22	7.449
1.11	3.894	29.13	2.517	5.841	43.70	3.775	7.789	58.27	5.034	9.736	72.83	6.292	11.68	87.40	7.551
1.12	3.947	29.53	2.551	5.921	44.29	3.826	7.894	59.06	5.102	9.868	73.82	6.377	11.84	88.58	7.653
1.13	4.000	29.92	2.585	6.000	44.89	3.878	8.000	59.85	5.170	10.00	74.81	6.463	12.00	89.77	7.756
1.14	4.053	30.32	2.620	6.080	45.48	3.929	8.106	60.64	5.239	10.13	75.81	6.549	12.16	90.97	7.859
1.15	4.107	30.72	2.654	6.160	46.08	3.981	8.213	61.44	5.308	10.27	76.81	6.635	12.32	92.17	7.962
1.16	4.160	31.12	2.689	6.241	46.69	4.033	8.321	62.25	5.378	10.40	77.81	6.722	12.48	93.37	8.067
1.17	4.214	31.53	2.724	6.321	47.29	4.086	8.429	63.05	5.447	10.54	78.82	6.809	12.64	94.58	8.171
1.18	4.268	31.93	2.759	6.403	47.90	4.138	8.537	63.86	5.517	10.67	79.83	6.897	12.81	95.80	8.276
1.19	4.323	32.34	2.794	6.484	48.51	4.191	8.646	64.68	5.588	10.81	80.85	6.985	12.97	97.02	8.381
1.20	4.377	32.75	2.829	6.566	49.12	4.244	8.755	65.49	5.658	10.94	81.87	7.073	13.13	98.24	8.487
1.21	4.432	33.16	2.865	6.648	49.74	4.297	8.864	66.31	5.729	11.08	82.89	7.161	13.30	99.47	8.594
1.22	4.487	33.57	2.900	6.731	50.35	4.350	8.975	67.14	5.800	11.22	83.92	7.250	13.46	100.7	8.700
1.23	4.543	33.98	2.936	6.814	50.97	4.404	9.085	67.97	5.872	11.36	84.96	7.340	13.63	101.9	8.808
1.24	4.598	34.40	2.972	6.897	51.60	4.458	9.196	68.80	5.943	11.50	86.00	7.429	13.79	103.2	8.915
1.25	4.654	34.82	3.008	6.981	52.22	4.512	9.308	69.63	6.016	11.63	87.04	7.519	13.96	104.4	9.023
1.26	4.710	35.23	3.044	7.065	52.85	4.566	9.420	70.47	6.088	11.77	88.08	7.610	14.13	105.7	9.132
1.27	4.766	35.65	3.080	7.149	53.48	4.620	9.532	71.31	6.160	11.91	89.14	7.701	14.30	107.0	9.241
1.28	4.822	36.08	3.117	7.234	54.11	4.675	9.645	72.15	6.233	12.06	90.19	7.792	14.47	108.2	9.350
1.29	4.879	36.50	3.153	7.318	54.75	4.730	9.758	73.00	6.307	12.20	91.25	7.883	14.64	109.5	9.460
1.30	4.936	36.92	3.190	7.404	55.39	4.785	9.872	73.85	6.380	12.34	92.31	7.975	14.81	110.8	9.570

APPENDIX E

SPECIAL SPECIES STATUS REPORT BOTANICAL SURVEY

Special Species Status Report
Botanical Survey
Property of David & Denise Jenks

(Revised 9/3/2003)

Navarro
Mendocino County, California

Prepared by
Laurie L. Berry
Botanist
North Coast Resource Management
P.O. Box 435
Calpella, CA 95418

For
Matt O'Connor
President, OEI

DATE: September 3, 2003

To: California Department of Forestry and Fire protection
Coast/Cascade region
135 Ridgeway Avenue
Santa Rosa CA 95401

California Fish and Game
Threatened and endangered Species Programs Analyst
Natural Heritage Division
1416 9th Street
Sacramento, CA 95814

From: Laurie L. Berry
North Coast Resource Management
P.O. Box 435
Calpella, CA 95418

Re: BOTANICAL SURVEY AND SPECIAL SPECIES STATUS REPORT FOR THE JENKS PROPERTY IN SECTION 28 & 33, T15N R15W, MDB&M.

1. Introduction

A rare plant survey and assessment was conducted for the Jenk's Property to determine habitat types found, presence or absence of rare plants, and possibility for adversely effecting rare plant populations.

2. Project Description

The Jenk's property is located approximately 2.8 air miles southeast of Navarro, CA. It contains a pond that is of interest pertaining to water rights issues related to the Navarro River that lies 1.2 miles southwest of the property. This property is 21.1 acres in size. The legal description of the plan area is as follows: a portion of Section 28 & 33, T15N R15W, MDB&M.

The site is vegetated Valley and Foothill Grassland , grape vineyards, and gardens.

3. Federal, State, and CNPS Rare Plant Protection Lists

Rare native vascular plants of California are catalogued in one or more of the following lists:

FE, FT, FSC	Federally Endangered Threatened, or Species of Concern.
SE, ST, SR, SSC	California State Endangered, Threatened, Rare or Species of Concern.
CNPS: 1A	California Native Plant Society's (CNPS) list 1A species (Plants presumed extinct in California)
CNPS: 1B	CNPS list 1B species (plants rare, threatened or endangered in California and elsewhere).
CNPS: 2	CNPS list 2 species (plants rare, threatened or endangered in California and elsewhere).
CNPS: 3	CNPS list 3 species (Plants which more information is needed).

The CNPS 2 and 3 listed plants have a limited protection under CEQA, but are included in an effort to help clarify the status of these plants.

The CNPS R-E-D Code

A classification system created by California Native Plant Society that helps distinguish between rarity, endangerment, and distribution. CNPS approach to protecting plants that only occur in California is different from plants that occur elsewhere.

R-Rarity

1. Rare, but found in sufficient numbers and distributed widely enough that the potential for extinction is low at this time.
2. Distributed in a limited number of occurrences, occasionally more if each occurrence is small.
3. Distributed in one to several highly restricted occurrences, or present in such small numbers that it is seldom reported.

E-Endangerment

1. Not endangered
2. Endangered in a portion of its range
3. Endangered throughout its range

D-Distribution

1. More or less widespread outside California
2. Rare outside California
3. Endemic to California

4. Survey Dates and Methodology

A. CNPS and CNDDB Queries

According to the California Native Plant Society (CNPS) Electronic Inventory of Rare or Endangered Vascular Plants of California and the California National Diversity Data Base (CNDDB), there are nine plant species that are rare and endangered in the Navarro, Baily Ridge, Cold Spring, and Philo quadrangles. Additional consideration for any other known species for the region was taken. See attachment for CNPS full data printouts for the above quadrangles. This rare plant assessment identifies rare native vascular plants of California that have been found to occur in the quadrants listed above. This plant list was compiled to help focus on the rare plants that have the highest probability of occurring in the project area.

Common Name *Scientific Name*	**Status**	**Associated Habitat**	**Blooming period**	**Habitat In plan area**
Humboldt milk-vetch *Astragalus agnicidus*	CNPS; 1B Federal; Species of Concern State; Endangered	Broadleaved upland forest, Disturbed openings in partially timbered forest lands	June-September	No
Swamp harebell *Campanula californica*	CNPS; 1B	Bogs and fens, Closed-cone coniferous forest, Coastal prairie, Meadows, Marshes and swamps (freshwater), North Coast coniferous forest/ mesic	June-October	Possible
Streamside daisy *Erigeron biolettii*	CNPS; 3	Broadleaved upland forest, Cismontane woodland, North Coast coniferous forest/ rocky, mesic	June-September	No
Coast fawn lily *Erythronium revolutum*	CNPS; 2	Bogs and fens, Broadleaved upland forest, North Coast coniferous forest/ mesic, streambanks	March-June	No
Roderick's fritillary *Fritillaria roderickii*	CNPS; 1B State; Endangered	Coastal bluff scrub, Coastal prairie, Valley and foothill grassland	March-May	Possible
Leafy-stemmed mitrewort *Mitella caulescens*	CNPS; 2	Broadleaved upland forest, Lower Montane coniferous forest, Meadows, North Coast coniferous forest/ mesic	May-July	Possible
North Coast semaphore grass *Pleuropogon hooverianus*	CNPS; 1B Federal; Species of Concern	Broadleaved upland forest, Meadows and seeps, North Coast coniferous forest	May-August	Possible
Maple-leaved	CNPS; 1B	Broadleaved upland forest,	April-	No

checkerbloom *Sidalcea malachroides*	Federal; Species of Concern	Coastal prairie, Coastal scrub, North Coast coniferous forest	August	
Long-beard lichen *Usnea longissima*	Not listed	North Coast coniferous forest, Broadleaved upland forest	N/A	No

B. Survey Dates

The site survey was conducted on 6/4/03 and 8/31/03.

C. Survey Methodology

The survey was conducted by searching in and around the pond, the ditches, grassy areas, and moist areas found between vineyard areas. During these searches, field notes on the species represented, and the habitat types were recorded.

D. Habitat Types

The CNPS electronic inventory lists the habitat that each rare plant grows within. Many rare plants require unique resources such as; serpentine soils, vernally wet soils, marshes, or swamps with open canopy. During surveys, the habitat types present on the property are noted. This information may then be used to include or exclude the possibility of rare plants to exist within the project area.

E. Blooming Periods

The ideal period in which to identify plants, rare or otherwise, is during their known blooming periods. The blooms of rare plants make locating and identifying plants much easier. Though this is the preferred method, it is not the only way to identify the presence or exclude the possibility of rare plants.

F. Plant Morphology

Other combinations of plant morphology characters including; leaves, fruit, growth form, and roots may be used to obtain plant classification in some cases when flowers are not present. This approach is most helpful for plants with very unique vegetative characters. This evaluation is often used to identify plants outside of their blooming period, and can be used to include or exclude the possibility of rare plants in a project area.

5. Botanical Survey Results

Of the nine plants listed above I have narrowed the list down to the four species that have a chance of surviving within the project area. I have excluded the following plants due to lack of habitat within the property area.

A. Plants Excluded due to Lack of Habitat

Humboldt milk-vetch *Astragalus agnicidus* lives in broadleaved upland forest, North Coast coniferous forest/ disturbed areas from 195-750 meters. This perennial herb blooms from June through September in Humboldt and Mendocino Counties. This Fabaceae family member is on CNPS List 1B/ RED 3-3-3.

Streamside daisy *Erigeron biolettii* is found in broadleaved upland forest, cismontane woodland, North Coast coniferous forest. Rocky, mesic from 30-1100 meters. This perennial herb blooms from June through September in Humboldt, Mendocino, Marin, Napa, Solano, and Sonoma Counties. This Asteraceae family member is on CNPS List 3/ RED ?-?-3.

Coast fawn lily *Erythronium revolutum revolutum* grows in bogs and fens, broadleaved upland forest, North Coast coniferous forest/ mesic, streambanks from 0-1065 meters. This bulbiferous perennial herb blooms from March through June in Del Norte, Humboldt, Mendocino, Siskiyou, and Sonoma Counties. This Liliaceae family member is on CNPS List 2/ RED 2-2-1.

Maple-leaved checkerbloom *Sidalcea malachroides* is found in broadleaved upland forest, coastal prairie, coastal scrub, North Coast coniferous forest/ often in disturbed areas from 2-700 meters. This perennial herb blooms from April through August in Del Norte, Humboldt, Mendocino, Monterey, Santa Clara, Santa Cruz, and Sonoma Counties. This Malvaceae family member is on CNPS List 1B/ RED 2-2-2.

Long-beard lichen *Usnea longissima* is found in North Coast coniferous forest and Broadleaved upland forest habitats from 0-2000 feet in California. This macrolichen grows in the "Redwood Zone" on a variety of trees including Big leaf maple, Oaks, Ash, Douglas-fir, and Bay (Tibor, 2001).

B. Search Results for Rare Plants

Roderick's fritillary ***Fritillaria roderickii*** is found in coastal bluff scrub, coastal prairie, valley and foothill grassland from 15-120 meters. This perennial (bulbiferous) herb blooms from March through May in Mendocino County. It is known from less that ten occurrences in Mendocino and Sonoma Counties. This Liliaceae family member is on CNPS List 1B/ RED 3-3-3. Roderick's fritillary was not found during botanical surveys.

Leafy-stemmed mitrewort ***Mitella caulescens*** is found in broadleaved upland forest, lower montane coniferous forest, meadows and seeps, North Coast coniferous forest/mesic from 610-1700 meters. This rhizomatous perennial herb blooms from May through July in Del Norte, Humboldt, Mendocino, Siskiyou, and Tehama Counties. This Saxifragaceae family member is on CNPS List 2/ RED 2-1-1. There was no sigh of leafy-stemmed mitrewort within the grassy areas of the property.

Swamp harebell ***Campanula californica*** is found in bogs and fens, closed-cone coniferous forest, coastal prairie, meadows and seeps, marshes and swamps (freshwater), North Coast coniferous forest/ mesic from 1-405 meters. This perennial herb (rhizomatous) blooms from June through October in Mendocino, Marin, Santa Cruz, and Sonoma Counties. This Campanulaceae family member is on CNPS List 1B/ RED 2-2-3. Swamp harebell was not found on this property. The reference population I visited containing *Campanula californica,* was on the coniferous forest floor in partial shade on the coast. These areas were moist unlike the dryer climate found inland between Philo and Navarro.

North Coast semaphore grass ***Pleuropogon hooverianus*** is found in broadleaved upland forest, meadows and seeps, marshes and swamps (freshwater), North Coast coniferous forest, vernal pools/ mesic from 10-635 meters. This perennial (rhizomatous) herb blooms from May through August in Mendocino, Marin, and Sonoma Counties. This Poaceae family member is on CNPS List 1B/ RED 3-3-3 and is classified as State Rare. There was no sign of North Coast semaphore grass within the property area.

C. List of Observed Flora

Habitat key; a=agriculture lands, A=pastures, b=coastal bluffs, B=coastal scrub, c=canyons, d=disturbed areas, D=dry, e=sandy, E=forest edges, f=Lower Montane Coniferous Forest, F=fields, g=Valley and foothill grassland, h=savannah, i=slopes, j=shrubs, k=shaded areas, l=lake shores, m=mesic areas, springs, marshes, vernal pools, n=rocky, o=open areas, p=ponds, q=meadows, Q=serpentine, r=roadsides, R=ridges, RED=redwood forest, s=streamsides, t=ditches, u=gravel, v=valleys, w=Cismontane Woodland , x=waste areas, y=orchards and gardens, z=Chapparal.

List of flora observed;	**Habitat**	**Rarity**
VASCULAR PLANTS DIVISION PTEROPHYTA		
DRYOPTERIDACEAE		
Maidenhair spleenwort *Asplenium trichomanes* ssp. *trichomanes*	n	common
Wood fern *Dryopteris arguta*	f,o,w	common
Polystichum californicum	f,o,r,s,w	common
Western sword fern *Polystichum munitum*	f,w	common
VASCULAR PLANTS IN DIVISION CONIFEROPHYTA GYMNOSPERMS		

CUPRESSACEAE		
Incense cedar *Calocedrus decurrens*	f	common
PINACEAE		
Grand fir *Abies grandis*	f	common
Sitka spruce *Picea sitchensis*	f	common
Knobcone pine *Pinus attenuata*	f	common
Lodgepole pine *Pinus contorta*	f	common
Bishop pine *Pinus muricata*	f	common
Gray pine *Pinus sabiniana*	f, w	common
Douglas-fir *Pseudotsuga menziesii*	f,g	common
TAXODIACEAE		
Dawn redwood *Metasequoia glyptostroboides*	f	exotic
Coast redwood *Sequoia sempervirens*	f	common
Giant sequoia *Sequoiadendron giganteum*	f	common

<u>VASCULAR PLANTS DIVISION ANTHOPHYTA ANGIOSPERMS
CLASS DICOTYLEDONAE TREES</u>

ACERACEAE		
Vine maple *Acer circinatum*	k,s	common
Big-leaf maple *Acer macrophyllum*	s,c	common
BETULACEAE		
White alder *Alnus rhombifólia*	s	uncommon
BIGNONIACEAE		
Desert-willow *Chilopsis linearis*	e	common
ERICACEAE		
Madrone *Arbutus menziesii*	f,w,g	common
FABACEAE		
Redbud *Cercis occidentalis*	f,w,g	common
FAGACEAE		
Coast live oak *Quercus agrifolia*	f,w,g	common
HIPPOCASTANACEAE		
California buckeye *Aesculus californica*	w,c	common
LAURACEAE		
California bay *Umbellularia californica*	f,w,g	common
MYRICACEAE		
Wax myrtle *Myrica californica*	f	common
PLATANACEAE		
Western sycamore *Platanus racemosa*	s	common
ROSACEAE		
Toyon *Heteromeles arbutifolia*	f,w,g	common

<u>VASCULAR PLANTS DIVISION ANTHOPYTA ANGIOSPERMS
CLASS DICOTYLEDONAE SHRUBS AND WOODY VINES</u>

ANACARDIACEAE		
Western poison oak *Toxicodendron diversilobum*	f,w,g	common
ERIACEAE		
Arctostaphylos hookeri	coastal scrub	common
Arctostaphylos manzanita	f	common
Arctostaphylos nummularia	f	common
Bearberry *Arctostaphylos uva-ursi*	e,f,i,r,z	common
GROSSULARIACEAE		
Chaparral currant *Ribes malvaceum*	w,z	common
Red flowering currant *Ribes sanguineum*	many	common
Fuchsia-flowered gooseberry *Ribes speciosum*	z,coastal scrub	common
RHAMNACEAE		
Deerbrush *Ceanothus integerrimus*	f,w,g	common
ROSACEAE		
Mountain mohogany *Cercocarpus betuloides*	f,w,g	common
Woodrose *Rosea gymnocarpa*	f,w,g	common
California blackberry *Rubus ursinus*	f,w,g	common

<u>VASCULAR PLANTS DIVISION ANTHOPHYTA ANGIOSPERMS</u>
<u>HERBS</u>

ARISTOLOCHIACEAE		
Asarum caudatum	f,mw	common
ASTERACEAE		
Yarrow *Achillea millefolium*	g,w	common
Bull thistle *Circium vulgare*	g	common
LAMIACEAE		
Field mint *Mentha pulegium*	f,g,w	common
OXALIDACEAE		
Redwood sorrel *Oxalis oregana*	f,m	common
PAPAVERACEAE		
California poppy *Eschscholzia californica*	g	common
PHILADELPACEAE		
Wild mock orange *Philadelphus lewisii*	f	common
POLYGONACEAE		
Sheep sorrel *Rumex acetosella*	g	common

<u>VASCULAR PLANTS DIVISION ANTHOPHYTA ANGIOSPERMS</u>
<u>CLASS MONOCOTYLEDONAE GRASSES, SEDGES AND RUSHES</u>

CYPERACEAE		
Nut-grass *Cyperus eragrostis*	f,w,g,p	common
JUNCACEAE		
Sedge *Juncus effusus*	f,w,g,p	common

POACEAE		
Slender wild Oats *Avena barbata*	f,w,g	exotic
California fescue *Festuca californica*	f,o,w,z	common
Idaho fescue *Festuca idahoensis*	d,k,o	common
Deergrass *Muhlenbergia rigens*		
Harding grass *Phalaris aquatica*	f,w,g	exotic

VASCULAR PLANTS DIVISION ANTHOPHYTA ANGIOSPERMS
CLASS MONOCOTYLEDONAE HERBS

IRIDACEAE		
Douglas iris *Iris douglassii*	f,w,g	common
Blue-eyed grass *Sisyrincheum bellum*	f,g,m,o,w	common
LILIACEAE		
Diogenes' lantern *Calochortus amabilis*	f,j,k,o,w	common
Soap plant *Chlorogalum pomeridianum*	b,d,f,g,w,z	common
Blue Dicks *Dichelostemma capitatum*	f.g.p.w. desert	common
Trilium *Trillium ovatum*	I,G,m,RED	common
POTAMOGETONACEAE		
Leafy pondweed *Potamogeton foliosus*	l,m,p,s,t	common

6. Discussion

None of the above listed plants were found to occur within the plan area. No mitigation measures are necessary for the protection of Astragalus agnicidus, Campanula californica, Erigeron biolettii, Erythronium revolutum, Fritillaria roderickii, Mitella caulescens, *Pleuropogon hooverianus, Sidalcea malachroides,* or *Usnea longissima*

References:

CalPhoto Database at http://elib.cs.berkeley.edu/photos/flora/, for photos, descriptions, and habitat ranges of rare and endangered plants found on CNPS and CNDDB queries.

Hickman, J.C. (ed). 1993. The Jepson Manual of the Higher Plants of California. University of California press, Berkeley, CA.

Holland, R.F. 1986. Preliminary Descriptions of the Terrestrial Plant Communities of California. California Department of Fish and Game, Sacramento.

Ulrich, L. 1994. Wildflowers of California. Companion Press, Santa Barara, CA.

Tibor, David P. (ed). 2001. California Native Plant Society's Inventory of Rare and Endangered Plants of California. California Native Plant Society, Sacramento,CA.

Report Author:

Laurie L. Berry
B.S. Botany in May 2004
Humboldt State University, Arcata, California

Full Data Report for the Selected Plants

CAMPANULA CALIFORNICA
"swamp harebell" **Family:** Campanulaceae

Life Form: Perennial herb (rhizomatous) **Blooms:** June-October
CNPS List: [1B] R/T/E in CA and elsewhere **R-E-D:** 2-2-3
State: [None] No state status
Federal: [None] No federal status
Counties: Mendocino, Marin, Santa Cruz [extirpated], Sonoma
Quads: Felton (408D) [extirpated], Tomales (485B), Drakes Bay (485C), Inverness (485D), Sebastopol (502A) [extirpated], Duncans Mills (503A) [extirpated], Bodega Head (503D) [extirpated], Warm Springs Dam (519A) [extirpated], Annapolis (520A), Stewarts Point (520B), Plantation (520D), Point Arena (537B), Saunders Reef (537C), Gualala (537D), Navarro (552A), Elk (552B), Albion (553A), Noyo Hill (568B), Mathison Peak (568C), Fort Bragg (569A), Mendocino (569D), Inglenook (585D)
Habitat: Bogs and fens, Closed-cone coniferous forest, Coastal prairie, Meadows, Marshes and Swamps (freshwater), North Coast coniferous forest / mesic
Elevation: 1-405 m.
Notes: Many occurrences have few plants. Threatened by grazing, development, marsh habitat loss, and logging. See Proceedings of the California Academy of Sciences I 2:158 (1861) for original description.

ERIGERON BIOLETTII
"streamside daisy" **Family:** Asteraceae

Life Form: Perennial herb **Blooms:** June-September
CNPS List: [3] More information is needed. **R-E-D:** ?-?-3
State: [None] No state status
Federal: [None] No federal status
Counties: Humboldt, Mendocino, Marin, Napa, Solano, Sonoma
Quads: Cordelia (482B), Petaluma River (484A), Sonoma (500C), Kenwood (501A), Camp Meeker (502B), Duncans Mills (503A), St. Helena (516C), Mark West Springs (517C), Calistoga (517D), Philo (551C), Garberville (617D)
Habitat: Broadleafed upland forest, Cismontane woodland, North Coast coniferous forest / rocky, mesic
Elevation: 30-1,100 m.
Notes: Move to List 1B? Location, rarity, and endangerment information needed. Most collections are very old. Intergrades with E. inornatus. See Manual of the Botany of the Region of San Francisco Bay, p. 181 (1894) by E. Greene for original description, and Phytologia 72(2):157-208 (1992) for taxonomic treatment.

ERYTHRONIUM REVOLUTUM
"coast fawn lily" **Family:** Liliaceae

Life Form: Perennial herb (bulbiferous) **Blooms:** March-June
CNPS List: [2] R/T/E in CA, but more common elsewhere **R-E-D:** 2-2-1
State: [None] No state status
Federal: [None] No federal status
Counties: Del Norte, Humboldt, Mendocino, Siskiyou, Sonoma, Oregon, Washington, and other states
Quads: Duncans Mills (503A), Philo (551C), Navarro (552A), Comptche (568D), Noble Butte (600B), Leggett (600C), Piercy (601A), Harris (616C), Bridgeville (635A), Iaqua Buttes (653B), Owl Creek (653C), Lord-Ellis Summit (671A), Maple Creek (671D), Eureka (672C), French Camp Ridge (688A), Hupa Mountain (688D), Weed (699B), Gasquet (739C)

ERYTHRONIUM REVOLUTUM (cont.)

Habitat: Bogs and fens, Broadleafed upland forest, North Coast coniferous forest / mesic, streambanks
Elevation: 0-1,065 m.
Notes: On watch list in OR, and state-listed as Sensitive in WA. See Madrono 3(2):93-99 (1935) for taxonomic treatment.

FRITILLARIA RODERICKII
"Roderick's fritillary" **Family:** Liliaceae

Life Form: Perennial herb (bulbiferous) **Blooms:** March-May
CNPS List: [1B] R/T/E in CA and elsewhere **R-E-D:** 3-3-3
State: [CE] State listed as Endangered (11/79)
Federal: [None] No federal status
Counties: Mendocino
Quads: Point Arena (537B) [extirpated], Saunders Reef (537C), Philo (551C), Boonville (551D), Laughlin Range (567D), Fort Bragg (569A)
Habitat: Coastal bluff scrub, Coastal prairie, Valley and foothill grassland
Elevation: 15-120 m.
Notes: Known from fewer than ten occurrences. Plants introduced in MEN (537D) and SON counties. Threatened by road maintenance, residential development, and erosion. Taxonomic validity has been questioned; further study needed. A synonym of F. biflora var. biflora in The Jepson Manual. USFWS uses the name F. grayana. See Four Seasons 2(2):14-16 (1967) for original description.

MITELLA CAULESCENS
"leafy-stemmed mitrewort" **Family:** Saxifragaceae

Life Form: Perennial herb (rhizomatous) **Blooms:** May-July
CNPS List: [2] R/T/E in CA, but more common elsewhere **R-E-D:** 2-1-1
State: [None] No state status
Federal: [None] No federal status
Counties: Del Norte, Humboldt, Mendocino, Siskiyou, Tehama, Idaho, Oregon, widespread outside of California
Quads: Navarro (552A), Elk (552B), Mathison Peak (568C), Mendocino (569D), Dutchmans Knoll (584C), Hales Grove (601D), Yolla Bolly 15' NW (613B), Iaqua Buttes (653B), Owl Creek (653C), Maple Creek (671D), Trinity Mtn. (686C), Etna (701B), Grider Valley (719B), Childs Hill (723A), Dutch Creek (736A), Preston Peak (738D)
Habitat: Broadleafed upland forest, Lower montane coniferous forest, Meadows, North Coast coniferous forest / mesic
Elevation: 60-1,700 m.

USNEA LONGISSIMA
LONG-BEARD LICHEN
Element Code: NLLEC5P420

List Status	NDDB Element Ranks	Other Lists
Federal: None	Global: G3	CNPS List:
State: None	State: S2.1	R-E-D Code:

—Habitat Associations—
General: NORTH COAST CONIFEROUS FOREST, BROADLEAFED UPLAND FOREST.
Micro: GROWS IN THE "REDWOOD ZONE" ON A VARIETY OF TREES INCL BIG LEAF MAPLE, OAKS, ASH, DOUG FIR, AND BAY. 0-2000' IN CALIF.

Occurrence No. 119 Map Index:48644
Occ Rank: Poor
Origin: Natural/Native occurrence
Presence: Presumed Extant
Trend: Unknown

—Dates Last Seen—
Element: 2002-07-03
Site: 2002-07-03

Lat/Long: 39°13'56" / 123°22'28"
UTM: Zone-10 N4342420 E467672
Precision: SPECIFIC
Symbol Type: POINT
Radius: 80 meters

Township: 16N
Range: 14W
Section: 23 Qtr NE
Meridian: M
Elevation: 1280 ft

Main Source: BORRAS, T. 2002 (OBS)
Quad Summary: ORRS SPRINGS (3912323/551A)*, BAILEY RIDGE (3912324/551B)
County Summary: MENDOCINO
SNA Summary:
Location: JUST EAST OF THE MONTGOMERY WOODS STATE RESERVE, 0.5 AIRMILE WNW OF ORRS SPRINGS, SOUTH OF THE SOUTH FORK BIG RIVER.

—Comments—
Distribution: MAPPED WITHIN THE SE 1/4 OF THE NE 1/4 OF SECTION 23.
Ecological: IN MATURE UPLAND DOUGLAS FIR FOREST, ON ROCKY NORTH-FACING SLOPE.
Threat: TIMBER HARVEST ACTIVITIES.
General: ACCORDING TO C. GOLEC, ONE SMALL DIAMETER MATURE DOUGLAS FIR TREE IS LIGHTLY COVERED BY USNEA LONGISSIMA. SITE NEEDS ADDITIONAL FIELD CHECKING.
Owner/Manager: PVT

ASTRAGALUS AGNICIDUS
HUMBOLDT MILK-VETCH
Element Code: PDFAB0F080

List Status	NDDB Element Ranks	Other Lists
Federal: Species of Concern	Global: G1	CNPS List: 1B
State: Endangered	State: S1.1	R-E-D Code: 3-3-3

Habitat Associations
General: BROADLEAFED UPLAND FOREST. ONLY KNOWN FROM ONE AREA IN HUMBOLDT COUNTY.
Micro: DISTURBED OPENINGS IN PARTIALLY TIMBERED FOREST LANDS. 575-750M.

Occurrence No. 21 Map Index:48559
Occ Rank: Poor
Origin: Natural/Native occurrence
Presence: Presumed Extant
Trend: Unknown

Dates Last Seen
Element: 2002-04-24
Site: 2002-04-24

Lat/Long: 39°11'51" / 123°27'29"
UTM: Zone-10 N4338604 E460428
Precision: SPECIFIC
Symbol Type: POINT
Radius: 80 meters

Township: 16N
Range: 14W
Section: 31 Qtr SW
Meridian: M
Elevation: 1000 ft

Main Source: POWERS, R. 2002 (OBS)
Quad Summary: BAILEY RIDGE (3912324/551B)
County Summary: MENDOCINO
SNA Summary:
Location: NORTH SLOPE OF UPPER LITTLE NORTH FORK NAVARRO RIVER CANYON, 1 MILE WSW OF OLD WRIGHT PLACE, NORTH OF BAILEY RIDGE.

Comments
Distribution: ALONG UNMAPPED ROAD ON WEST FACING SLOPE ON NORTH SLOPE OF CANYON. MAPPED WITHIN THE SE 1/4 OF THE SW 1/4 OF SECTION 31.
Ecological: ON ROAD CUT BANK ON HIGHLY DISTURBED SITE. NO CANOPY COVER PRESENT.
Threat: ON ROAD CUT BANK, ROAD IS PROPOSED FOR ABANDONMENT. PLANT WILL BE PROTECTED FROM EQUIPMENT.
General: ONE PLANT OBSERVED IN 2002.
Owner/Manager: PVT-MENDOCINO REDWOOD COMPANY

SIDALCEA MALACHROIDES
MAPLE-LEAVED CHECKERBLOOM
Element Code: PDMAL110E0

List Status	NDDB Element Ranks	Other Lists
Federal: Species of Concern	Global: G2	CNPS List: 1B
State: None	State: S2.2	R-E-D Code: 2-2-2

Habitat Associations
General: BROADLEAFED UPLAND FOREST, COASTAL PRAIRIE, COASTAL SCRUB, NORTH COAST CONIFEROUS FOREST.
Micro: WOODLANDS AND CLEARINGS NEAR COAST; OFTEN IN DISTURBED AREAS. 2-760M.

Occurrence No. 9 Map Index:27914
Occ Rank: Unknown
Origin: Natural/Native occurrence
Presence: Presumed Extant
Trend: Unknown

Dates Last Seen — Element: 1937-06-08; Site: 1937-06-08

Lat/Long: 38°59'12" / 123°37'41"
UTM: Zone-10 N4315279 E445613
Precision: NON-SPECIFIC
Symbol Type: POINT
Radius: 1 mile

Township: 13N
Range: 16W
Section: 15 Qtr XX
Meridian: M
Elevation: 600 ft

Main Source: ROSE #37349 CAS #265285 (HERB)
Quad Summary: POINT ARENA (3812386/537B)*, EUREKA HILL (3812385/537A), COLD SPRING (3912315/552D), MALLO PASS CREEK (3912316/552C)
County Summary: MENDOCINO
SNA Summary:
Location: 7 MILES NORTHEAST OF POINT ARENA.

Comments
Distribution: MAPPED NEAR HEAD OF MILL CREEK. ACTUAL COLLECTION MAY HAVE BEEN MADE ALONG HIGHWAY 1 OR ANY OF SEVERAL ROADS THAT HEAD EAST FROM THE HIGHWAY (SUCH AS MOUNTAIN VIEW ROAD). CNDDB SITE IS BEST GUESS.
Ecological:
Threat:
General: ONLY SOURCE OF INFORMATION FOR THIS SITE IS 1937 COLLECTION BY ROSE.
Owner/Manager: UNKNOWN

Occurrence No. 12 Map Index:07234
Occ Rank: Unknown
Origin: Natural/Native occurrence
Presence: Presumed Extant
Trend: Unknown

Dates Last Seen — Element: 1903-05-XX; Site: 1903-05-XX

Lat/Long: 39°15'48" / 123°35'46"
UTM: Zone-10 N4345960 E448572
Precision: NON-SPECIFIC
Symbol Type: POINT
Radius: 1 mile

Township: 16N
Range: 16W
Section: 12 Qtr XX
Meridian: M
Elevation: 500 ft

Main Source: MCMURPHY #161 DS #31735 (HERB)
Quad Summary: COMPTCHE (3912335/568D)*, NAVARRO (3912325/552A)
County Summary: MENDOCINO
SNA Summary:
Location: COMPTCHE.

Comments
Distribution:
Ecological:
Threat:
General: ONLY SOURCE OF INFORMATION FOR THIS SITE IS 1903 COLLECTION BY MCMURPHY.
Owner/Manager: UNKNOWN

ERYTHRONIUM REVOLUTUM
COAST FAWN LILY
Element Code: PMLIL0U0F0

List Status		NDDB Element Ranks		Other Lists	
Federal:	None	Global:	G4	CNPS List:	2
State:	None	State:	S2.2	R-E-D Code:	2-2-1

—Habitat Associations—
General: BOGS AND FENS, BROADLEAFED UPLAND FOREST, NORTH COAST CONIFEROUS FOREST.
Micro: 0-1065M.

Occurrence No. 1 Map Index: 47173
Occ Rank: Unknown
Origin: Natural/Native occurrence
Presence: Presumed Extant
Trend: Unknown
Main Source: HULBERT, R. SN CAS (HERB)
Quad Summary: PHILO (3912314/551C)
County Summary: MENDOCINO
SNA Summary:
Location: NEAR PHILO.

—Dates Last Seen—
Element: XXXX-XX-XX
Site: XXXX-XX-XX

Lat/Long: 39°04'00" / 123°26'30"
UTM: Zone-10 N4324065 E461784
Precision: NON-SPECIFIC
Symbol Type: POINT
Radius: 1 mile

Township: 14N
Range: 14W
Section: 18 Qtr XX
Meridian: M
Elevation:

—Comments—
Distribution:
Ecological:
Threat:
General: NEEDS FIELDWORK.
Owner/Manager: UNKNOWN

Occurrence No. 2 Map Index: 47174
Occ Rank: Unknown
Origin: Natural/Native occurrence
Presence: Presumed Extant
Trend: Unknown
Main Source: APPLEGATE, I. #7019 DS (HERB)
Quad Summary: NAVARRO (3912325/552A)
County Summary: MENDOCINO
SNA Summary:
Location: NAVARRO (WENDLING).

—Dates Last Seen—
Element: 1932-03-19
Site: 1932-03-19

Lat/Long: 39°09'07" / 123°32'29"
UTM: Zone-10 N4333593 E453196
Precision: NON-SPECIFIC
Symbol Type: POINT
Radius: 1 mile

Township: 15N
Range: 15W
Section: 20 Qtr XX
Meridian: M
Elevation:

—Comments—
Distribution:
Ecological: ON TIMBERED AND BRUSHY W-FRONTING HILLSIDE; IN WET SOIL UNDER REDWOODS.
Threat:
General: NEEDS FIELDWORK. COLLECTION FROM "1 MILE NORTH OF NAVARRO" (BAKER #5645) ALSO ATTRIBUTED TO THIS SITE.
Owner/Manager: UNKNOWN

Occurrence No. 3 Map Index: 07234
Occ Rank: Unknown
Origin: Natural/Native occurrence
Presence: Presumed Extant
Trend: Unknown
Main Source: PURDY, C. SN UC #30094 (HERB)
Quad Summary: COMPTCHE (3912335/568D)*, NAVARRO (3912325/552A)
County Summary: MENDOCINO
SNA Summary:
Location: COMPTCHE, NEAR UKIAH.

—Dates Last Seen—
Element: 1897-XX-XX
Site: 1897-XX-XX

Lat/Long: 39°15'48" / 123°35'46"
UTM: Zone-10 N4345960 E448572
Precision: NON-SPECIFIC
Symbol Type: POINT
Radius: 1 mile

Township: 16N
Range: 16W
Section: 12 Qtr XX
Meridian: M
Elevation: 500 ft

—Comments—
Distribution:
Ecological:
Threat:
General: NEEDS FIELDWORK.
Owner/Manager: UNKNOWN

FRITILLARIA RODERICKII
RODERICK'S FRITILLARY
Element Code: PMLIL0V0M0

List Status	NDDB Element Ranks	Other Lists
Federal: Species of Concern	Global: G1Q	CNPS List: 1B
State: Endangered	State: S1.1	R-E-D Code: 3-3-3

Habitat Associations
General: COASTAL BLUFF SCRUB, COASTAL PRAIRIE, VALLEY AND FOOTHILL GRASSLAND. ENDEMIC TO MENDOCINO COUNTY.
Micro: GRASSY SLOPES, MESAS. 15-610M.

Occurrence No. 4 Map Index: 07445
Occ Rank: Excellent
Origin: Natural/Native occurrence
Presence: Presumed Extant
Trend: Increasing

Dates Last Seen
Element: 1994-04-26
Site: 1994-04-26

Lat/Long: 39°01'31" / 123°22'55"
UTM: Zone-10 N4319442 E466937
Precision: SPECIFIC
Symbol Type: POINT
Radius: 80 meters

Township: 13N
Range: 14W
Section: 34 Qtr SE
Meridian: M
Elevation: 400 ft

Main Source: THE NATURE CONSERVANCY 1992 (LIT)
Quad Summary: PHILO (3912314/551C)
County Summary: MENDOCINO
SNA Summary: Boonville
Location: SOUTHEAST CORNER OF EVERGREEN (AKA BOONVILLE, GREEN WOOD) CEMETERY, AND ALONG BORDERING ROAD, BOONVILLE.

Comments
Distribution: GROWING IN THE OLD SECTION OF THE CEMETERY.
Ecological: HEAVY YELLOW CLAY. ASSOCIATED WITH RANUNCULUS OCCIDENTALIS, BRIZA, SISYRINCHIUM.
Threat: THREATS: INTRODUCED GRASSES, BROOM (CYTISUS), AND VINCA.
General: 100'S OF PLANTS SEEN IN 1983, 200-300 IN 1984, 463 IN 1986, 537 IN 1988, 416 IN 1989, 312 IN 1990, 220 IN 1991, AND 343 IN 1992. SITE PROTECTED BY CEMETERY CARETAKER AND MONITORED BY TNC SINCE 1986.
Owner/Manager: PVT

PLEUROPOGON HOOVERIANUS
NORTH COAST SEMAPHORE GRASS
Element Code: PMPOA7Y031

List Status	NDDB Element Ranks	Other Lists
Federal: Species of Concern	Global: G1	CNPS List: 1B
State: Threatened	State: S1.1	R-E-D Code: 3-3-3

—Habitat Associations—
General: BROADLEAFED UPLAND FOREST, MEADOWS AND SEEPS, NORTH COAST CONIFEROUS FOREST.
Micro: WET GRASSY, USUALLY SHADY AREAS, SOMETIMES FRESHWATER MARSH; ASSOCIATED WITH FOREST ENVIRONMENTS; 10-1150M.

Occurrence No. 10 Map Index: 07234
Occ Rank: None
Origin: Natural/Native occurrence
Presence: Possibly Extirpated
Trend: Unknown

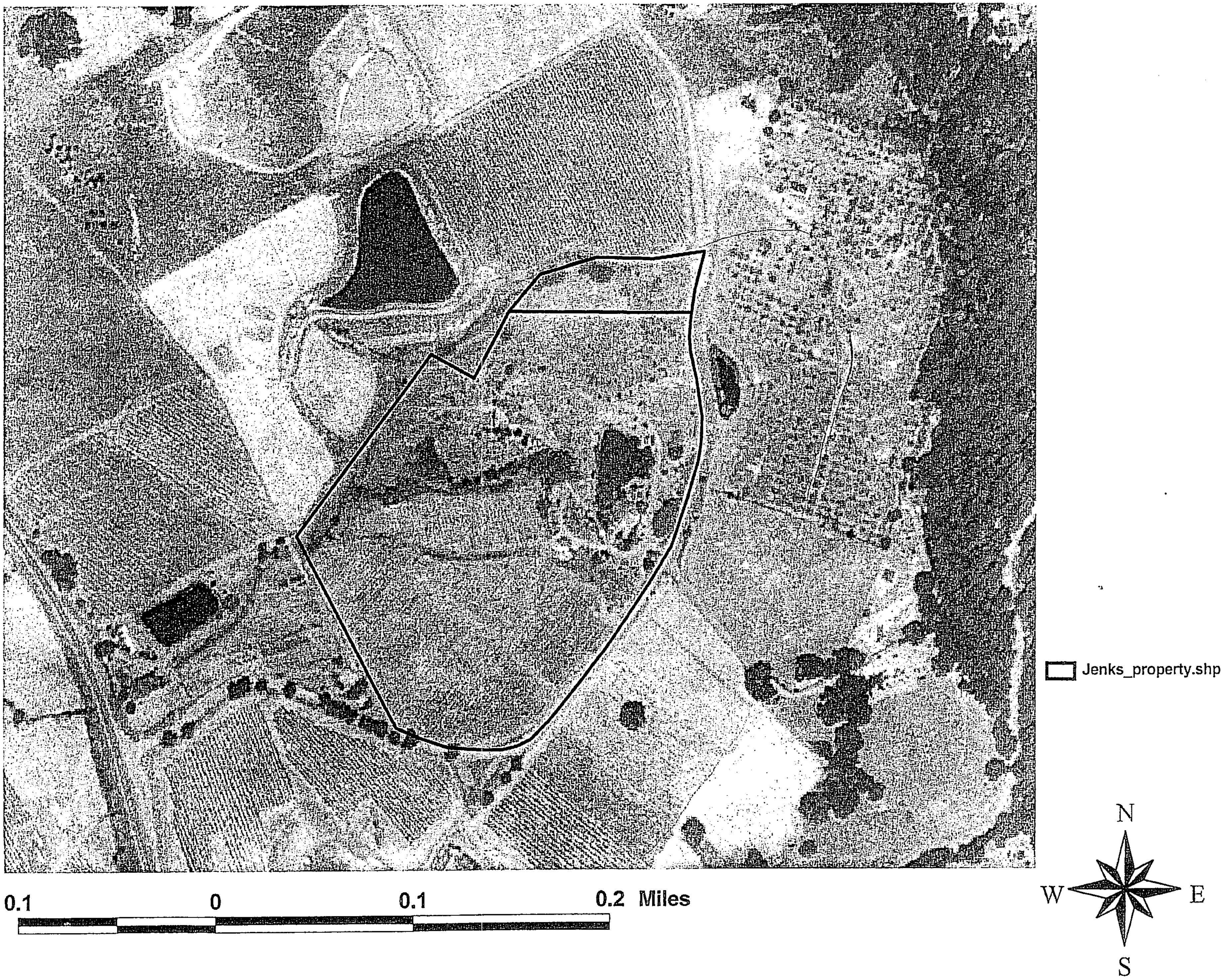
—Dates Last Seen—
Element: 1903-05-XX
Site: 2000-XX-XX

Lat/Long: 39°15'48" / 123°35'46"
UTM: Zone-10 N4345960 E448572
Precision: NON-SPECIFIC
Symbol Type: POINT
Radius: 1 mile

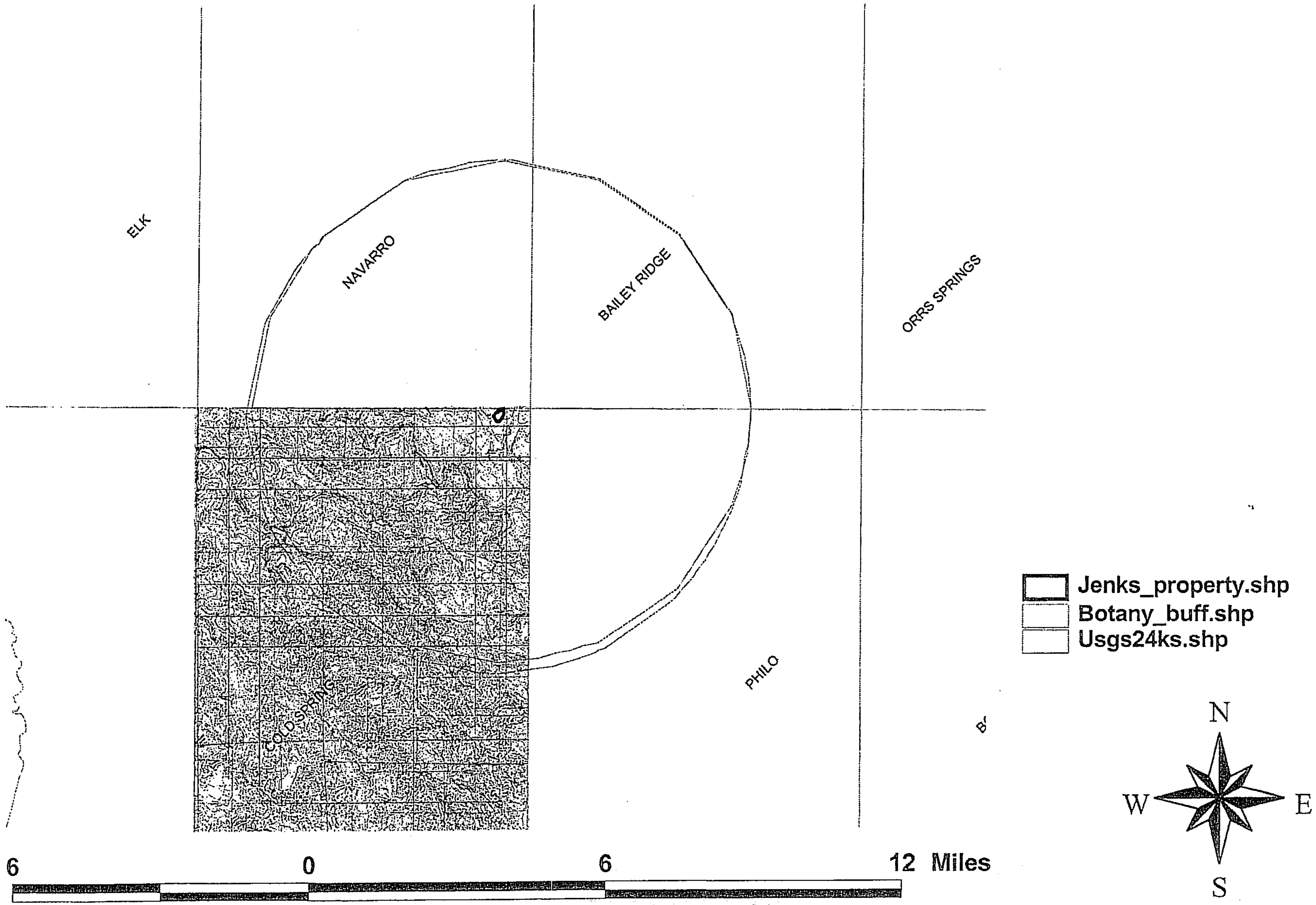
Township: 16N
Range: 16W
Section: 12 Qtr XX
Meridian: M
Elevation: 500 ft

Main Source: MCMURPHY, J. #455 CAS (HERB)
Quad Summary: COMPTCHE (3912335/568D)*, NAVARRO (3912325/552A)
County Summary: MENDOCINO
SNA Summary:
Location: COMPTCHE.

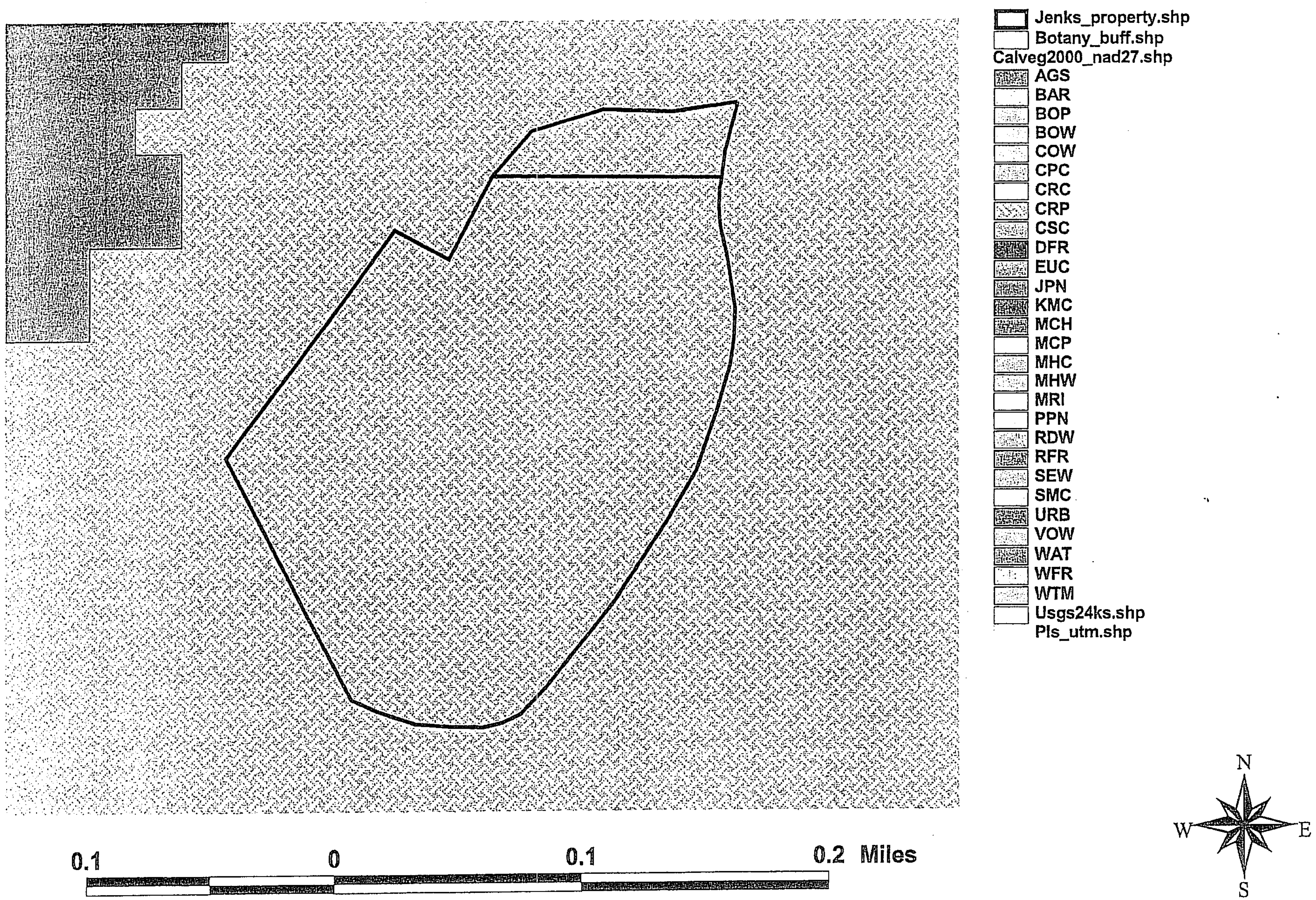
—Comments—
Distribution:
Ecological:
Threat:
General: ONLY SOURCE OF INFORMATION IS 1903 COLLECTION BY MCMURPHY; SURVEYS IN 1999 AND 2000 BY C. WILLIAMS FAILED TO LOCATE PLANTS. LOCATION IS REMOTE, COOLEY BELIEVES SITE COULD STILL BE EXTANT.
Owner/Manager: UNKNOWN


Jenks_property.shp
0.1
0
0.1
0.2 Miles
N
W
E
S

Jenk's Home Botanical Buffer



Jenk's WHR Habitat Map



APPENDIX F

WILDLIFE BIOLOGICAL ASSESSMENT

Wildlife Research Associates

Trish and Greg Tatarian
1119 Burbank Avenue
Santa Rosa, CA 95407
Ph: 707.544.6273 Fax: 707.544.6317
http://www.wildliferesearch1.com
trish@wildliferesearch1.com
greg@wildliferesearch1.com

December 10, 2004

Mr. Ernie Ralston
Matrix Environmental
301 East Street
Healdsburg, CA 95448

Ph: 707-433-7334
Fax: 707-433-7336

RE: Wildlife Biological Assessment - Jenks Property, Mendocino County, CA

Dear Ernie,

The following is a letter report describing the results of our biological assessment for wildlife of the 21-acre Jenks property located at 2700 Guntley Road, Philo, in the northern portion of Anderson Valley, in central Mendocino County, California. This assessment is conducted to provide background information for a State Water Resources Control Board water rights application, in which the entire 21-acre parcel was evaluated. This assessment evaluates the following; a) the potential for past and present occurrence of special-status animal species, and b) the likelihood that these species once occurred within the existing project area (based on the presence of potential habitat in the upstream and downstream sections of the unnamed tributary to Floodgate Creek, as well as the current conditions of the property and the on-site reservoir). Potential impacts from the reservoir creation to potentially-occurring special-status species are also discussed.

SITE DESCRIPTION

The roughly oval-shaped, 21-acre parcel is located east of Highway 128 on the northwest side of Guntley Road. The parcel is located on Section 33 of the Cold Spring 7.5-minute topographic quadrangle, within Township 15N and Range 16W. Surrounding land uses consist mainly of vineyards and livestock pastures. The property ranges in elevation between 384 and 316 feet and includes two unnamed tributaries to Floodgate Creek; one located on the northern portion of the site and the second located on the south side the property. Both tributaries flow from east to west.

The reservoir, located in between the unnamed tributaries to Floodgate Creek, impounds approximately 3.8 acre feet of water, gravity-flows to a pump where it is distributed to a vineyard and ornamental trees (Figures 2 and 3). After the reservoir was built in 1998, the property owners - the Jenks - irrigated a much larger vineyard but recently cut back to 1.5 acres. Since most of the parcel was likely converted to an irrigated landscape after the dam was constructed, for this report we assumed the entire 21 acres is the "'water place of use" and therefore subject to surveys.

METHODS

Information on special-status animal species was compiled through a review of the California Natural Diversity Data Base (CNDDB 2004) for the Cold Spring, Philo, Bailey Ridge and Navarro topographic quadrangles, the CDFG's Special Animals List (CDFG 2004), and State and Federally Listed Endangered and Threatened Animals of California (CDFG 2004).

Aerial photographs from Mendocino County were reviewed prior to the site visit. Photographs were available for 1972 (pre-conversion conditions prior to construction of the reservoir) and for 2000 (current conditions).

Trish Tatarian conducted a reconnaissance of the site on November 16, 2004. The reservoir area and surrounding habitats were evaluated for suitable habitat for special-status animal species. The reconnaissance-level site visit was intended only as an evaluation of on-site and adjacent habitat types, and no special-status species surveys were conducted as part of this effort. The late winter season is an inappropriate time to conduct surveys for either nesting birds or roosting bats based on the high mobility and seasonal occurrence and/or activity of these taxa. However, some conclusions about previous occupancy can be made based on the evidence left behind by these species, i.e., nesting material (birds), and fecal staining and guano (bats).

EXISTING CONDITIONS

The project area is located within the Klamath/North Coast Bioregion San (Welsh 1994). This bioregion is located in northwestern portion of California and extends from the Pacific Coast eastward more than halfway across California to the Modoc Plateau and the Sacramento Valley floor (Welsh 1994). Habitats within this bioregion include both mesic (moist) habitats, such as freshwater marsh, and xeric (dry) habitats, such as mixed conifer habitat and chaparral, and are typical of a Mediterranean type climate. The Klamath/North Coast is the state's wettest climate, with rainfall distribution varying widely from an average annual 38 inches at Fort Bragg to 80 or more inches inland.

The 2700 Guntley Lane project area is located north of Mill Creek and northeast of the Navarro River, in the northeastern portion of Anderson Valley (Figure 1). Topographically, the project site is located on a predominant west facing slope near the top of a ridge that is located between Mill Creek/Meyer Gulch and the unnamed tributary to Floodgate Creek.

Pre-conversion Conditions

Based on photographs taken in 1972, pre-conversion conditions consisted of grasslands. These are assumed to be non-native grasslands based on previous grazing by cattle or sheep, and by horses (Jenks, pers. comm.). Several large redwood trees occurred on-site near the eastern portion of the site; this suggests that the site may have once been part of the coastal redwood forest prior to European settlement.

Two tributaries occur on-site; one in the northern portion of the site and another in the southern portion of the site. The northern drainage is located along the fence line and the southern drainage along the southern portion of the property.

Current Conditions

Two buildings are located on the property; a main residence located south of the northern tributary, and a guest house that was converted from horse stables (Jenks, pers. comm.). Prior to the current owners buying the property in 1990, but after 1972, the site was used as a horse ranch (Jenks, pers. comm.). The large redwood trees (diameter at breast height greater than 5 feet) are present in the eastern portion of the site.

The two tributaries visible in the 1972 aerial photographs still occur on the site. The northern tributary has no defined bed or bank until it converges with the southern tributary. The southern tributary has a steeply sided and deeply incised channel (approximately 12 inches in depth) (Figure 4 and 5). This channel once flowed through a vineyard, however the vineyard has been removed and blackberry bushes are slowly becoming established. The reservoir is located north of the house, outside of the channel both tributaries. Surface water runoff from Guntley Lane and the vineyard located on the southeast side of Guntley Road (once an apple orchard (Jenks, pers. comm.)), flows into the reservoir (Figure 6). A small decorative pool occurs northwest of the reservoir, below the western bank (Figure 7).

Wildlife Habitats

The value of a site to wildlife is influenced by a combination of the physical and biological features of the immediate environment. Species diversity is a function of diversity of abiotic and biotic conditions and is greatly affected by human use of the land. The wildlife habitat quality of an area, therefore, is ultimately determined by the type, size, and diversity of vegetation communities present and their degree of disturbance. Wildlife habitats are typically distinguished by vegetation type, with varying combinations of plant species providing different resources for use by wildlife. The following is a discussion of the wildlife species supported by the on-site habitats and the pre-conversion habitats expected to occur on site based on aerial photographs. Habitat descriptions are based on *A Guide to Wildlife Habitats of California* (Mayer and Laudenslayer 1989).

Pre-Conversion Conditions
Grassland habitat, including native and non-native grasslands, typically provides habitat for a wide variety of common wildlife species. Previously a horse ranch, the likelihood of native bunch grasses occurring on site is none, based on the sensitivity of native grasses to overgrazing and trampling. Unlike cattle, horses graze grasses to the ground, leaving little opportunity for regrowth. Non-native grasslands provide suitable habitat for a variety of common wildlife species that were observed during the site reconnaissance (see below).

Current Conditions
Non-irrigated grassland habitat occurs in the eastern portion of the property. Landscape plants and the remnant vineyard are irrigated and receive water from the reservoir. Many of the landscape plantings are native species, which provide habitat for a variety of avian species. Species observed on the site include American robin (*Turdus migratorius*), red-winged blackbird (*Agelaius phoeniceus*), European starlings (*Sturnus vulgaris*), yellow-rumped warbler (*Dendroica coronata*), California Towhee (*Pipilo crissalis*), California quail (*Callipepla californica*), western scrub jay (*Aphelocoma californica*), Stellar's jay (*Cyanocitta stelleri*), dark-eyed junco (*Junco hyemalis*), white-breasted nuthatch (*Sitta carolinensis*), common ravens (*Corvus corax*), house finch (*Carpodacus mexicanus*), Anna's hummingbird (*Calypte anna*), and black phoebe (*Sayornis nigricans*). An American peregrine falcon (*Falco peregrinus*) (first year bird based on the brown plumage), was observed hunting over the property during the field visit. Western fence lizards (*Sceloporus occidentalis*), which feed on invertebrates found within and beneath debris within the grasslands were observed on site. Mammal species and their signs observed in the grasslands include Botta's pocket gopher (*Thomomys bottae*), California vole (*Microtus californicus*), jack rabbit (*Lepus californicus*), striped skunk (*Mephitis mephitis*) and raccoon (*Procyon lotor*).

The reservoir is occupied by bullfrogs (*Rana catesbeiana*) and 18 individuals were observed in the large reservoir and 6 individuals were observed in the small decorative pool near the guest house. Pacific treefrogs (*Pseudacris regilla*) were heard in the surrounding upland habitat.

Movement Corridors

Wildlife movement includes migration (i.e., usually one way per season), inter-population movement (i.e., long-term genetic flow) and small travel pathways (i.e., daily movement corridors within an animal's territory). While small travel pathways usually facilitate movement for daily home range activities such as foraging or escape from predators, they also provide connection between outlying populations and the main corridor, permitting an increase in gene flow among populations.

These linkages among habitat types can extend for miles between primary habitat areas and occur on a large scale throughout California. Habitat linkages facilitate movement among populations located in discrete areas and populations located within larger habitat areas. The mosaic of habitats found within a large-scale landscape results in wildlife populations that consist of discrete sub-populations comprising a large single population, which is often referred to as a meta-population. Even where patches of pristine habitat are fragmented, such as occurs with coastal scrub, the movement between wildlife populations is facilitated through habitat linkages, migration corridors and movement corridors. Depending on the condition of the corridor, genetic flow between populations may be high in frequency, thus allowing high genetic diversity within the population, or may be low in frequency. Potentially low frequency genetic flow may lead to complete isolation, and if pressures are strong, potential extinction (McCullough 1996; Whittaker 1998).

This site is connected to the remaining upland habitats that have not been converted to vineyards. Thus, there are no barriers of wildlife movement.

SPECIAL-STATUS BIOLOGICAL RESOURCES

Certain vegetation communities, and plant and animal species, are designated as having special-status based on their overall rarity, endangerment, restricted distribution, and/or unique habitat requirements. In general, special-status is a combination of these factors that leads to the designation of a species as sensitive. The Federal Endangered Species Act (FESA) outlines the procedures whereby species are listed as endangered or threatened and established a program for the conservation of such species and the habitats in which they occur. The California Endangered Species Act (CESA) amends the California Fish and Game Code to protect species deemed to be locally endangered and essentially expands the number of species protected under the FESA.

Special-status Animal Species

Special-status animal species include those listed by the USFWS (2004) and the CDFG (2004c, 2004d). The USFWS officially lists species as either Threatened or Endangered, and as candidates for listing. Additional species receive federal protection under the Bald Eagle Protection Act *(e.g.*, bald eagle, golden eagle), the Migratory Bird Treaty Act (MBTA), and state protection under CEQA Section 15380(d). In addition, many other species are considered by the CDFG to be species of special concern; these are listed in Remsen (1978), Williams (1986), and Jennings and Hayes (1994). Although such species are afforded no official legal status, they may receive special consideration during the planning and CEQA review stages of certain development projects. The CDFG further classifies some species under the following categories: "fully protected", "protected fur-bearer", "protected amphibian", and "protected reptile". The designation "protected" indicates that a species may not be taken or possessed except under special permit from the CDFG; "fully protected" indicates that a species can be taken for scientific purposes by permit only.

A total of 12 special-status animal species were evaluated for their potential to occur within the study area, based on: 1) a review of the CNDDB, 2) a review of the "Special Animals" list (CDFG 2004) that includes those wildlife species whose breeding populations are in serious decline, and 3) the habitat observed to be present on the site. See Table 1 for a list of the species evaluated. None of these species have a high potential for occurrence at the project site; however, several species are considered to have a low potential for occurrence within or adjacent to the study area based on the habitats present. These species are discussed below. Species that have no likelihood to occur on site but are prominent in today's regulatory environment (e.g., bats) are also discussed below.

Table 1.
Special Status Species and their Potential for Occurrence on Site

Common Name *Scientific Name*	**Status** USFWS/CDFG	**Habitat Affinities**	**Potential for Occurrence**
Mammals			
red tree vole *Arborimus pomo*	SC/CSC	Inhabits old growth, North Coast coniferous forests, redwood forests, and montane hardwood coniferous forests. Found in the North Coast fog belt from Oregon to Sonoma County.	None: no suitable habitat present on site
pallid bat *Antrozous pallidus*	-/CSC	Day roosts include rock outcrops, mines, caves, hollow trees, buildings and bridges, with a potential high reliance on tree roosts	High: Large diameter redwood trees may provide roosting habitat.
long-eared Myotis *Myotis evotis*	SC/-	Day roosts in hollow trees under exfoliating bark, and crevices in rock outcrops. Found roosting under bark of small black oaks in northern California.	High: Large diameter redwood trees may provide roosting habitat
long-legged Myotis *Myotis volans*	SC/-	Day roosts in hollow trees, particularly large diameter snags or live trees with lightning scars.	High: Large diameter redwood trees may provide roosting habitat
Birds			
sharp-shined hawk *Accipiter striatus*	MB/CSC	Dense canopy pine or mixed conifer forest and riparian habitats. Water within one mile required.	Moderate: suitable nesting habitat occurs in the larger trees on site
American peregrine falcon *Falco peregrinus anatum*	FE, MB/CE	Nests and roosts on protected ledges of high cliffs, usually adjacent to lakes, rivers or marshes. Forages on shorebirds and small passerines.	None: no suitable habitat present on site
black phoebe *Sayornis nigricans*	MB/-	Nests in anthropogenic structures on ledges. Nest made of mud pellets, dry grasses, weed stems, plant fibers and hair.	High: suitable nesting habitat occurs on site
Allen's hummingbird *Selasphorus sasin*	SC, MB/-	Nests in wooded areas, meadows, or thickets along shaded streams, on a branch low down on stem, although placement height varies between 10 inches and 90 feet.	High: suitable nesting habitat occurs on site
Amphibians			
tailed frog *Ascaphus truei*	SC/CSC	Range occurs from extreme northern Mendocino County to British Columbia. Inhabits cold, perennial streams, primarily in mature and old growth stands.	None: no suitable habitat present on site
California red-legged frog *Rana aurora draytonii*	FT/CSC	Prefers semi-permanent and permanent stream pools, ponds and creeks with emergent and/or riparian vegetation. Occupies upland habitat especially during the wet winter months.	Moderate: reservoir provides suitable breeding habitat
foothill yellow-legged frog *Rana boylii*	SC/CSC	Inhabits permanent, flowing stream courses with a cobble substrate and a	None: no suitable habitat present on site

Rana boylii		mixture of open canopy riparian vegetation.	present on site
Fish			
Navarro roach *Lavinia symmetricus navarroensis*	-/CSC	Habitat generalists which are found in warm intermittent streams and cold well-aerated streams.	None: no suitable habitat present on site

Bats:
The large redwood trees on-site may provide day-roosting habitat for colonial bat species, such as pallid bat (*Antrozous pallidus*), Yuma myotis (*Myotis yumanensis*), long-eared myotis (*Myotis evotis*), and long-legged myotis (*Myotis volans*), based on the potential for suitable crevices and cavities.

Nesting Birds:
No nests were observed during the site reconnaissance; however November occurs after the breeding season and often stick nests do not last from year to year. Several passerine (perching birds) species, such as California towhee, scrub jays, white-breasted nuthatch and chestnut-backed chickadee, that were observed during the November site reconnaissance may nest on the site and may used the reservoir for drinking and bathing.

Conclusion

This section discusses the potential impacts from the reservoir current conditions at 2700 Guntley Lane. The analysis of these impacts is based on a single reconnaissance-level survey of the study area, a review of historic and existing aerial photographs, databases and literature, and personal professional experience with biological resources of the region.

Conversion from non-native grassland habitat, that existed in 1972, to a reservoir and native plantings, built in 1998, resulted in no loss of habitat for special-status species. This is because all of the special-status species reported in the area require specific habitats, such as cold, perennial streams, primarily in mature and old growth stands, which were not present on site in 1972. Non-native grasslands provide habitat for common species not protected under FESA or CESA. As a result, no significant impacts from the conversion occurred.

The reservoir is currently fed by surface runoff from Guntley Road and does not divert water from either of the unnamed tributaries. Therefore, water levels in the tributaries have not been decreased through diversion.

The reservoir is perennial and provides year round habitat for the invasive bullfrog. Bullfrogs were introduced into California between 1890 and 1920 to supplement the reduced populations of California red-legged frog (*Rana aurora draytonii*) that were being used by French restaurants in San Francisco (Moyle 1973, Jennings and Hayes 1996). Bullfrogs have been one of the causes in the elimination of the California red-legged frog (*Rana aurora draytonii*) from the Central Valley and Sierra foothill ponds. Laboratory experiments have shown that under natural conditions, the presence of bullfrog tadpoles nearly precluded the recruitment of CRF tadpoles to the juvenile stage (Lawler, *et al.* 1999). The control of bullfrogs in this area of Anderson Valley is infeasible as there are more than six large impoundments within one-half mile that more than likely support bullfrog populations and provide source populations for the 3.8-acre reservoir. Therefore, no action is recommended.

Please call if you have any questions regarding this report.

Sincerely,

Trish Tatarian

REFERENCES

BAICICH, P. AND C. HARRISON. 1997. A GUIDE TO NESTS, EGGS AND NESTLINGS OF NORTH AMERICAN BIRDS. SECOND EDITION. NATURAL WORLD ACADEMIC PRESS. SAN DIEGO. 347 PP.

CALIFORNIA DEPARTMENT OF FISH AND GAME (CDFG). 1999. LIST OF CALIFORNIA TERRESTRIAL NATURAL COMMUNITIES RECOGNIZED BY THE NATURAL DIVERSITY DATA BASE. NATURAL HERITAGE DIVISION. JANUARY.

CALIFORNIA DEPARTMENT OF FISH AND GAME (CDFG). 2004A. SPECIAL ANIMALS. NATURAL DIVERSITY DATA BASE, WILDLIFE AND HABITAT DATA ANALYSIS BRANCH. JANUARY.

CALIFORNIA DEPARTMENT OF FISH AND GAME (CDFG). 2004B. STATE AND FEDERALLY LISTED ENDANGERED AND THREATENED ANIMALS OF CALIFORNIA. NATURAL DIVERSITY DATA BASE, WILDLIFE AND HABITAT DATA ANALYSIS BRANCH. JANUARY.

CALIFORNIA NATURAL DIVERSITY DATA BASE (CNDDB). 2004. REPORTED OCCURRENCES FOR THE COLD SPRING, PHILO, BAILEY RIDGE AND NAVARRO 7.5-MINUTE TOPOGRAPHIC QUADRANGLES. WILDLIFE CONSERVATION DIVISION. SACRAMENTO, CALIFORNIA . NOVEMBER 3.

CALIFORNIA DEPARTMENT OF FISH AND GAME (CDFG). 1988B. CALIFORNIA'S WILDLIFE - AMPHIBIANS AND REPTILE. VOLUME I. CALIFORNIA DEPARTMENT OF FISH AND GAME. EDITORS, ZEINER, D.C., W.F. LAUDENSLAYER, JR., AND K.E. MAYER.

CALL, MAYO W. 1978. NEST SURVEYS. TECHNICAL NOTES-316. BUREAU OF LAND MANAGEMENT

GRINNELL, J. AND A. MILLER. 1944. THE DISTRIBUTION OF THE BIRDS OF CALIFORNIA. ARTEMISIA PRESS, LEE VINING, CALIFORNIA.

HICKMAN, J.C. 1993. THE JEPSON MANUAL: HIGHER PLANTS OF CALIFORNIA. UNIVERSITY OF CALIFORNIA PRESS, BERKELEY, CALIFORNIA. 1400 PP.

JENNINGS, M.R. AND M.P. HAYES. 1994. AMPHIBIAN AND REPTILE SPECIES OF SPECIAL CONCERN IN CALIFORNIA. PREPARED FOR THE CALIF. DEPT. OF FISH AND GAME INLAND FISHERIES DIV. RANCHO CORDOVA, CALIF. NOVEMBER 1. 255 PP.

LAWLER, S. P., D. DRITZ, T. STRANGE AND M. HOLYOAK. 1999. EFFECTS OF INTRODUCED MOSQUITOFISH AND BULLFROGS ON THE THREATENED CALIFORNIA RED-LEGGED FROG. CONSERVATION BIOLOGY VOL. 13(3): 613-622.

MAYER, K.E. AND W. F. LAUDENSLAYER, JR. EDS. 1988. A GUIDE TO WILDLIFE HABITATS OF CALIFORNIA. CALIFORNIA DEPARTMENT OF FORESTRY AND FIRE PROTECTION. SACRAMENTO. 166 PP.

MCCULLOUGH, D. 1996. METAPOPULATIONS AND WILDLIFE CONSERVATION. ISLAND PRESS. 429PP.

MOYLE MOYLE, P.B. 1973. EFFECTS OF INTRODUCED BULLFROGS, RANA CATESBEIANA, ON THE NATIVE FROGS OF THE SAN JOAQUIN VALLEY, CALIFORNIA. COPEIA 1973(1): 18-23.

REMSEN, H.V. 1988. BIRD SPECIES OF SPECIAL CONCERN IN CALIFORNIA: AN ANNOTATED LIST OF DECLINING OR VULNERABLE BIRD SPECIES. CALIFORNIA DEPARTMENT OF FISH AND GAME, THE RESOURCES AGENCY.

STEBBINS, R. C. 1985. A FIELD GUIDE TO WESTERN REPTILES AND AMPHIBIANS. HOUGHTON MIFFLIN COMPANY.

U.S. FISH AND WILDLIFE SERVICE (USFWS). 2004. THREATENED AND ENDANGERED SPECIES SYSTEM (TESS) CANDIDATE SPECIES AS OF 2/20/2004.

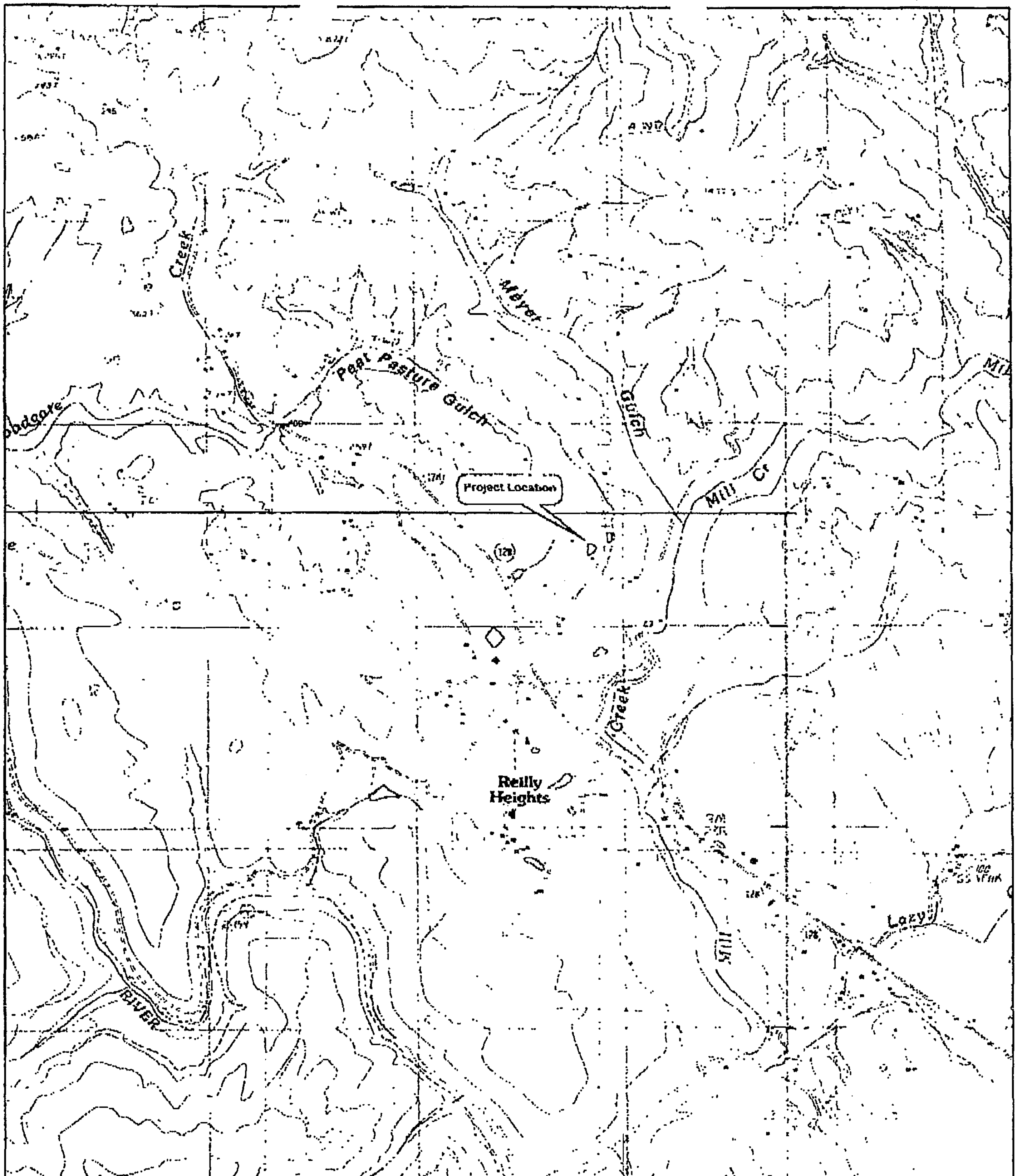
WELSH, H. 1994. BIOREGIONS: AN ECOLOGICAL AND EVOLUTIONARY PERSPECTIVE AND A PROPOSAL FOR CALIFORNIA. CALIFORNIA FISH AND GAME (80) 3:97-124.

WHITTAKER, R. 1998. ISLAND BIOGEOGRAPHY: ECOLOGY, EVOLUTION AND CONSERVATION. OXFORD UNIVERSITY PRESS. 285PP.

WILLIAMS, D.F. 1986. MAMMALIAN SPECIES OF SPECIAL CONCERN IN CALIFORNIA. CALIFORNIA DEPARTMENT OF FISH AND GAME. WILDLIFE MANAGEMENT DIVISION ADMINISTRATIVE REPORT 86-1. 112 PP.

PERSONAL COMMUNICATIONS

JENKS, D. 2004. HOME OWNER. PERSONAL COMMUNICATION WITH TRISH TATARIAN. NOVEMBER 16.



Name: COLD SPRING
Date: 12/10/2004
Scale: 1 inch equals 2000 feet

Location: 10 0455349 E 4330358 N
Caption: Figure 1 - Project Location

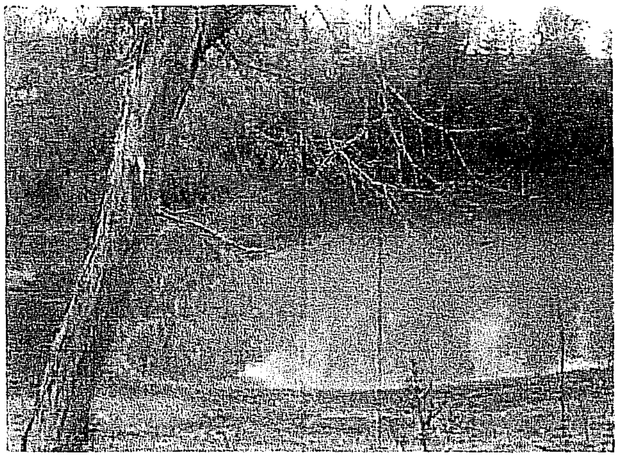


Figure 2. Reservoir looking east.

Figure 3. Reservoir looking southeast.

Figure 4. Southern drainage.

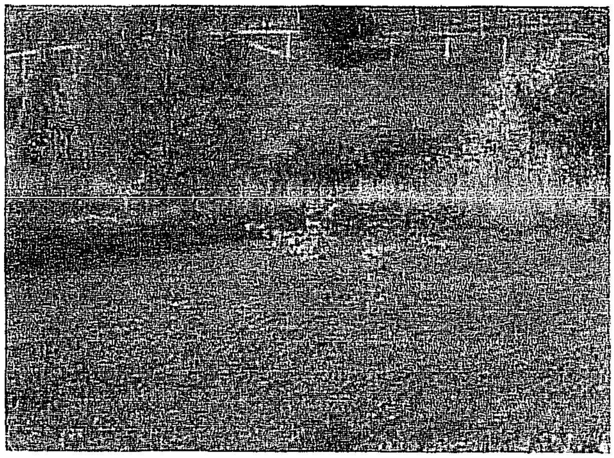


Figure 5. Western portion of northern drainage.

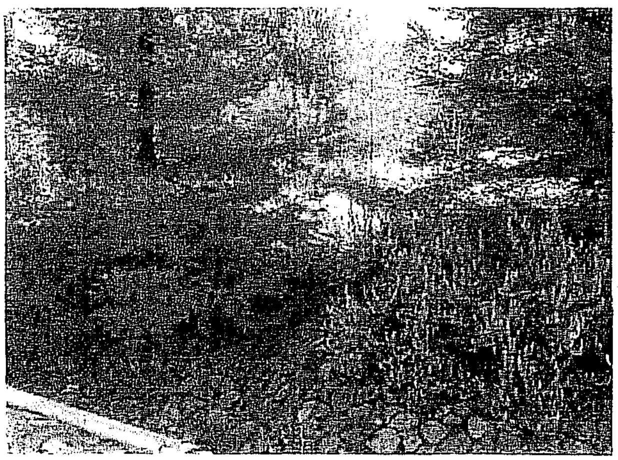


Figure 6. Culvert area from Guntley Road.

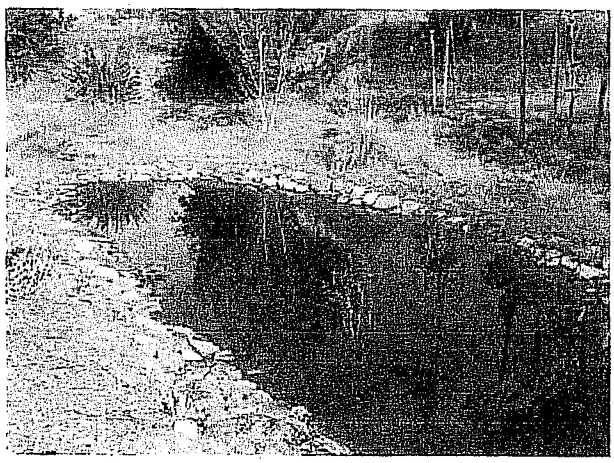


Figure 7. Decorative pool below reservoir.

APPENDIX G

EXAMPLE FORMAT FOR WAA/CFII

August 4, 2004

EXAMPLE FORMAT FOR WAA/CFII REPORT

TO: Chief, Division of Water Rights, State Water Resources Control Board

FROM: ____

DATE: ____________

SUBJECT: WATER AVAILABILITY ANALYSIS (WAA) FOR APPLICATION [Number] OF [Applicant Name]

1.0 INTRODUCTION

The purpose of this report is to summarize the results of the water availability analysis conducted for the subject application located within the ________________ Creek watershed in ____________ County. The objectives of the analysis are as follows:

- To provide information required under California Water Code section 1275 (a) to demonstrate whether water is available for appropriation; and
- To determine the impact of the applications/project on streamflow in order to evaluate the impacts to fishery resources as required by the California Environmental Quality Act (CEQA), the California Endangered Species Act (CESA), and the federal Endangered Species Act (ESA).

Figure 1 shows the location of the_______ Creek watershed, the project's point(s) of diversion, and other features in the area.

Include a Project Map as Figure 1

2.0 PROJECT DESCRIPTION

The project is located in _________ County approximately _________ miles _________ of the town of _________. The application seeks to (store/directly divert) _________ acre-feet (af) of water into an (existing/proposed) (offstream/on-stream) reservoir during the season of _________ to _________. Application _________ requests (diversion to storage/direct diversion) for the purposes of _________. *List any changes made to the original application, such as if the applicant has agreed to reduce the amount or season of diversion.*

3.0 METHODS

3.1 Rainfall-Runoff Method

Rainfall runoff methods use rainfall data and land use characteristics to calculate runoff for a particular watershed area. When the rate of rainfall exceeds the rate of infiltration of water into the ground, excess water (runoff) is available to supply surface waters. The rational method is typically used by engineers and hydrologists to design hydraulic structures and predict peak flood flows. However, under the assumptions discussed below, the rational method is used to estimate the average annual runoff based on the average annual precipitation. The equation is shown below:

$$Q = C\,I\,A$$

Where: Q = Estimated average annual runoff (acre-feet per annum);
C = Runoff coefficient;
I = Average annual precipitation (feet per annum); and
A = Tributary watershed area (acres)

The runoff coefficient "C" in the rational method equation represents the percent of water that will run off the ground surface during a storm event. The California Department of Transportation (Caltrans) Highway Design Manual provides tables (See Appendix A) showing various values for "C" depending on soil type, relief, vegetation and surface storage[1]. Where multiple land uses are found within the watershed, it is customary to use an area-weighted runoff coefficient[2]. In addition, the runoff coefficients given in the Caltrans Highway Design Manual are applicable for storms of up to 5 or 10 year frequencies. Less frequent, higher intensity storms require adjustment[3].

Since the rational method is so commonly used, it is important to note the assumptions in its development. The equation assumes that rainfall is of equal intensity over the entire watershed. Because actual rainfall rates vary over space and time, the rational method

[1] California Department of Transportation. *Highway Design Manual*, July 1, 1995. http://www.dot.ca.gov/hq/oppd/hdm/hdmtoc.htm

[2] Bedient and Huber. *Hydrology and Floodplain Analysis*, 2nd ed. 1992. Pg 395.

[3] Linsley, et al. *Water Resources Engineering*, 4th edition, 1992. Pg. 59.

should only be used within small watershed areas where rainfall is likely to be relatively uniform. For estimation of peak flows, the rational method should not be used for areas larger than 0.5~1 mi^2 (321~640 acres)[2,3]. When the rational method is used with larger watersheds, the peak runoff will generally be over-predicted[3]. Larger watersheds that include significant tributary inflows should be divided into smaller areas and modeled using flow routing methods or regional regression equations[3].

3.2 Proration of U.S.Geological Survey Streamflow Data

Streamflow was estimated based on a proration of areas using the following formula:

$Q_2 = Q_1 \times (A_2/A_1) \times (I_2/I_1)$

Where: Q_2 = Daily flow (cfs) at point of interest on tributary watershed;
Q_1 = Daily flow (cfs) at nearby gage;
A_2 = Watershed area above point of interest;
A_1 = Watershed area above nearby gage;
I_2 = Precipitation at point of interest; and
I_1 = Precipitation at nearby gage

3.3 Other Flow Estimation Methods

Please describe any other methodology used if the procedure in section 3.2 is not followed.

4.0 ANNUAL UNIMPAIRED FLOW

Annual unimpaired flow is the total volume of water, on average, that would flow past a particular point of interest on an annual basis if no diversions (impairments) were taking place in the watershed above that point. Different methods may be used to estimate the unimpaired flow, including flow data from a relatively unimpaired streamflow gage (drainage area-ratio method) or a rainfall-runoff relationship. Flow is measured in units of acre-feet per year.

4.1 Data and Assumptions

Please indicate which streamflow gage and/or rain gage data were used in the analysis. Include the station name and number, agency that collected the data, and the period of record used. Please include an electronic copy of any spreadsheets containing the hydrologic data used.

4.2 Calculations

Please include all assumptions, show equations used, calculation(s), and results.

5.0 UNIMPAIRED FLOW DURING THE PROJECT'S DIVERSION SEASON

Unimpaired flow during the project's diversion season is the total volume of water, on average, that would flow past a selected point of interest on a seasonal basis if no diversions (impairments) were taking place in the watershed above that point. Flow is measured in units of acre-feet.

5.1 Data and Assumptions

Indicate which streamflow gage and/or rain gage data were used in the analysis. Include the station name and number, agency that collected the data, and the period of record used. Please include an electronic copy of any spreadsheets containing the hydrologic data used.

5.2 Calculations

Please include all assumptions, show equations used, calculation(s), and results.

6.0 BYPASS FLOW

The bypass flow is the instantaneous flow rate to be maintained past a project's point of diversion, in units of cubic feet per second. The appropriate bypass is developed on a case-by-case basis. For projects located in the "coastal" watersheds in the counties of Mendocino, Sonoma, Marin and Napa, the National Marine Fisheries Service (NMFS), the California Department of Fish and Game (DFG) and Division staff have recommended that, in most cases, a bypass that is equal to the February median flow be used where needed to protect fish habitat[4].

The February median flow at the point of diversion is estimated to be ________ cfs, based on the proration of the flow data recorded at the ___________ gage.

A total of ________ acre-feet of water is requested to be (diverted / stored in the reservoir). Using the _______ method, the tributary area above the point of diversion has an estimated runoff of _________ acre-feet during the allowable season of ______ to ______. The estimated bypass flow is ______cubic feet per second (cfs), based on the prorated February median flow from the flow data recorded at _________ gage. During the allowable season of diversion, this bypass rate amounts to _______ acre-feet. Therefore, after the bypass flow has been met, there is approximately ________ acre-feet of water available for the applicant to divert.

7.0 CUMULATIVE FLOW IMPAIRMENT INDEX

Pursuant to the CEQA, CESA and ESA, the Division is required to evaluate the cumulative impacts to the natural hydrology. The Cumulative Flow Impairment Index (**CFII**) is an index that is used to evaluate the cumulative flow impairment demand of all existing and pending projects in a watershed of interest. The CFII is a percentage obtained by dividing the **Demand** in acre-feet by the **Supply** in acre-feet at a specified point of interest (**POI**)[5], and for a specified time period, where:

---

[4] State Water Resources Control Board Staff Report, *Assessing Site Specific and Cumulative Impacts on Anadromous Fishery Resources in Coastal Watersheds in Northern California*, January 23, 2001.

[5] Points of interest (POIs), should be determined in consultation with staff of the Division, NMFS, and DFG.

Demand is the "face" value entitlements of all existing and pending water rights, under all bases of right, from October 1 through March 31, above the POI in acre-feet, using the Division's Water Rights Information Management System (WRIMS) database and water right files (See Appendix B). Demand includes existing and pending water right applications for "Post-1914" appropriators, Statements of Water Diversion and Use for "Riparian" and "Pre-1914" appropriators, small domestic use registrations, stockpond registrations, and any other known authorized diversions; and

Supply is the seasonal average unimpaired flow above the POI in acre-feet. For the "coastal" watersheds in the counties of Mendocino, Sonoma, Marin and Napa the season of December 15 through March 31 is used to compute supply[6].

Based on the Division's Water Rights Information System Management (WRIMS) database, the total entitlements of recorded water rights above the POIs are estimated to be **XXX** acre-feet for POI 1; **XXX** for POI 2; etc. (See Appendix B). *Please clearly state all assumptions that were made in developing the demand estimates.*

The total unimpaired water available at the POIs were estimated to be **XXX** acre-feet at POI 1; **XXX** acre-feet at POI 2; etc. The CFII values were estimated as follows:

CFII @ POI 1 = Demand (af) ÷ Supply (af)) x 100% = _____%;
CFII @ POI 2 = Demand (af) ÷ Supply (af)) x 100% = _____%;
etc.

[6] National Marine Fisheries Service and The California Department of Fish and Game, *Guidelines for Maintaining Instream Flows to Protect Fisheries Resources Downstream of Water Diversions in Mid-California Coastal Streams*, June 17, 2002.

August 21, 2002

APPENDIX A
Runoff Coefficient for Undeveloped Areas

	Watershed Types			
	Extreme	High	Normal	Low
Relief	0.28 – 0.35 Steep, rugged terrain with average slopes above 30%	0.20 – 0.28 Hilly, with average slopes of 10 to 30%	0.14 – 0.20 Rolling with average slope of 5 to 10%	0.08 – 0.14 Relatively flat land, with average slope of 0 to 5%
Soil Saturation	0.12 – 0.16 No effective soil cover; either rock or thin soil mantle of negligible infiltration capacity	0.08 – 0.12 Slow to take up water; clay or loam soil of low infiltration capacity; imperfectly or poorly drained	0.06 – 0.08 Normal; well-drained, high or medium-textured soils, sandy loams, silt and silty loams.	0.04 – 0.06 High; deep sand or other soil that takes up water readily, very high level drained soils.
Vegetal Cover	0.12 – 0.16 No effective plant cover, bare, or very sparse cover	0.08 – 0.12 Poor to fair; clean cultivation crops, or poor natural cover, less than 20% of drainage area over good cover	0.06 – 0.08 Fair to good; about 50% of area in good grassland or woodland, not more than 50% of area in cultivated crops	0.04 – 0.06 Good to excellent; about 90% of drainage area in good grassland, woodland or equivalent cover
Surface Storage	0.10 – 0.12 Negligible surface depression few and shallow; drainage ways steep and small, no marshes	0.08 – 0.10 Low; very well defined system of drainage ways; no ponds or marshes	0.06 – 0.08 Normal; considerable surface depression storage, lakes and pond marshes	0.04 – 0.06 High; surface storage high; drainage system not sharply defined, large floodplain storage or large number of pond marshes

Example 1: The watershed above project site consisting of:
1) Hilly terrain with average slope of 15%,
2) Well-drained gravelly loams,
3) Planted with grapes, and
4) Low, well-defined

Find the runoff coefficient, C, for the above watershed.

Solutions:
Relief = 0.25
Soil infiltration = 0.11
Vegetal Cover = 0.07
Surface storage = 0.09

C = 0.52

Reference Source: California Department of Transportation, *Highway Design Manual*, July 1, 1995, pp. 810-816.

August 21, 2002

APPENDIX B
Demand above Point(s) of Interest

Point of Interest ID: ________________________________

A Water Right ID	B Source	C Season	D Maximum Face Value Demand Amount by Direct Diversion or Storage	E Adjustment to Maximum Face Value Demand Amount (Explain Reasons in Footnotes Below*)
Application, Statement, Small Domestic Use Registration, or Stockpond Registration Number	ABC Creek Tributary to XYZ River	MM/DD to MM/DD	XXX cfs and/or XXX acre-feet	XXX cfs and/or XXX acre-feet

			Total Face Value Demand (Acre-Feet)	**Total Adjusted Demand (Acre-Feet)**

(*Place footnotes explaining adjustments shown in Column E here)

APPENDIX H

GUIDELINES FOR MAINTAINING INSTREAM FLOWS TO PROTECT FISHERIES RESOURCES DOWNSTREAM OF WATER DIVERSIONS IN MID-CALIFORNIA COASTAL STREAMS

DRAFT

Guidelines for Maintaining Instream Flows to Protect Fisheries Resources Downstream of Water Diversions in Mid-California Coastal Streams

(An update of the May 22, 2000 Guidelines)

California Department of Fish and Game

and the

National Marine Fisheries Service

June 17, 2002

(Errata note, dated 8-19-02)

California Department of Fish and Game
1416 Ninth Street
Sacramento, California 95814

National Marine Fisheries Service
Southwest Region
777 Sonoma Ave, Rm 325
Santa Rosa, California 95404

STATE OF CALIFORNIA – THE RESOURCES AGENCY

DEPARTMENT OF FISH AND GAME
POST OFFICE BOX 47
YOUNTVILLE, CALIFORNIA 94599
(707) 944-5500

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
777 Sonoma Avenue, Room 325
Santa Rosa, California 95404

June 17, 2002

Mr. Ed Anton, Chief
State Water Resources Control Board
P.O. Box 2000
Sacramento, California 95812

Dear Mr. Anton:

In May 2000, DFG and NMFS distributed draft guidelines for maintaining instream flows to protect fisheries resources downstream of water diversions in mid-California coastal streams. These guidelines provided bypass flow recommendations and measures for protecting natural hydrographs that were reviewed and supported by peer review (Moyle et al. 2000). Previously permitted on-stream reservoirs have limited the ability of the SWRCB to use the guideline component concerned with avoiding cumulative impacts. Subsequent analysis and discussions by SWRCB, DFG, and NMFS staff have resulted in an alternative approach for conserving natural hydrographs and assessing cumulative impacts of multiple water projects. This method, which has been adopted by SWRCB staff, involves computation of a Cumulative Flow Impairment Index (CFII).

Although DFG, NMFS, and SWRCB environmental staff are in agreement on the application of this new method, there has been no clear written description of this procedure. Furthermore, the relationship of this procedure to DFG/NMFS guidelines for water diversions has been unstated. For that reason, we have updated DFG/NMFS May 22, 2000 guidelines to include use of the CFII method for conserving natural stream hydrographs and addressing the issue of cumulative impacts. Enclosed are six copies of these updated draft guidelines.

We greatly appreciate the efforts of SWRCB staff in helping to develop components of these guidelines. We look forward to continued opportunities for the State Water Resources Control Board and our agencies to cooperate in the conservation of listed species. If you have any questions or comments concerning the guidelines, contact Dr. William Hearn (NMFS) at (707) 575-6062 or Ms. Linda Hanson (DFG) at (707) 944-5562.

Sincerely,

Mr. James Bybee
NMFS Habitat Manager
Northern California

Mr. Robert W. Floerke, Regional Manager
Department of Fish & Game
Central Coast Region

ERRATA

These guidelines were initially distributed to the California State Water Resources Control Board on June 17, 2002. Copies were then widely distributed to interested parties. A minor error and inconsistency in the guidelines was subsequently detected. For clarification the following error and intended correction is noted:

On page 7, in paragraph 2 under Section II-B-Item 5 (Protection of the Natural Hydrograph and Avoidance of Cumulative Impacts), Line 16 and Line 18 incorrectly provide a season of October 1 to March 31 for computations of unimpaired runoff. Consistent with Appendix A, the correct season for computation of unimpaired runoff is December 15 to March 31.

TABLE OF CONTENTS

Errata ii

I. INTRODUCTION 1

II. TERMS AND CONDITIONS TO BE INCORPORATED INTO WATER RIGHTS PERMITS FOR SMALL DIVERSIONS 4

Diversions > 3 cfs or > 200 acre-feet 4

Small Diversions • 3 cfs and • 200 acre-feet 4

- Geographic Limitations 4
- Seasonal Limits on Additional Diversions 5
- No Additional Permitting of Small On-stream Reservoirs 6
- Maintenance of Minimum Bypass Flows 6
- Protection of the Natural Hydrograph and Avoidance of Cumulative Impacts 7
- Fish Passage and Protection Measures 8
- Special circumstances allowing onstream reservoirs 8
- Quantify All Water Rights of Applicant 9
- Compliance and Monitoring Measures 9

III COMPLIANCE AND EFFECTIVENESS MONITORING 11

Program to Verify Effectiveness and Refine the Flow Standard as Necessary 11

Compliance and Enforcement Program 11

Preventing Stream Over-Allocation 12

Addendum A

Procedures for assessing cumulative impacts of water diversions based on the cumulative total volume of diverted water 13

DRAFT

Guidelines for Maintaining Instream Flows to Protect Fisheries Resources Downstream of Water Diversions in Mid-California Coastal Streams

1. INTRODUCTION

The California Department of Fish and Game (DFG) and the National Marine Fisheries Service (NMFS) jointly developed draft guidelines for diverting water from central-coastal watersheds in California. Those guidelines, which were dated May 22, 2000, were developed in response to concern that current practices for issuing water rights were not adequate to protect and recover anadromous salmonids in coastal watersheds. These watersheds are often highly regulated, extensively developed and subject to significant levels of impairment. Depletion and storage of stream flows have significantly altered natural hydrological cycles and adversely affected aquatic habitats and resources. Reduced flows also interrupt invertebrate drift, disrupt channel dynamics, increase deposition of fine sediments, inhibit recruitment of spawning gravels, and promote encroachment of riparian and non-endemic vegetation into spawning and rearing areas.

The May 22, 2000 guidelines were developed pursuant to respective agency mandates and missions to protect and restore anadromous salmonids and their habitats. These guidelines provide standard recommended protective terms and conditions to be followed in the absence of site-specific, biological, and hydrologic assessments. The guidelines call for limiting new water right permits to diversions during the winter period (December 15-March 31) when stream flows are generally high. Minimum bypass flows and cumulative maximum rates of diversion are recommended to ensure that streams are adequately protected from new winter diversions. The guidelines also recommend that, except for limited circumstances, storage ponds should be constructed off-stream, rather than on-stream. Water diversions should also be screened using NMFS or DFG screening criteria, and fish passage facilities should be provided where appropriate.

The May 22, 2000 guidelines recommended that conservation of the natural hydrograph and avoidance of significant cumulative impacts could be accomplished by limiting the cumulative maximum rate of diversion from a watershed. The recommended cumulative maximum rate of diversion is equivalent to 15% of the "winter 20% exceedence flow" at the point of diversion. Following its distribution, the State Water Resources Control Board (SWRCB) staff stated that the DFG/NMFS guideline element for protecting the natural hydrograph and limiting cumulative impacts to salmonids was impractical, because many existing, legal storage ponds store 100% of a stream's runoff while they are filling. Therefore, on-stream ponds inherently exceed any maximum rate of diversion, at least temporarily. Rather than adopt a quantitative procedure to address this problem, SWRCB proposed an alternative approach for protecting the natural hydrograph and limiting cumulative impacts of numerous diversions. That alternative approach, described in SWRCB (2001), limits cumulative impacts and conserves the natural hydrograph by limiting the maximum cumulative volume of water that can be diverted in a watershed. Similar to the maximum rate of diversion, this maximum cumulative volume guideline is recommended for projects for which there has been insufficient site-specific, biological assessment of instream flow needs to protect fisheries. DFG and NMFS accept the reasonableness of this alternative "cumulative volume" approach to limiting cumulative impacts. Therefore, this update of the May 22, 2000 guidelines provides a technical description of the calculations required for this alternative method (see Appendix A). This update also reflects a minor change to the May 22, 2000 guidelines by noting that protecting spawning habitat for salmonids is largely achieved through conservation of the natural hydrograph. Except for these two changes, this update of the DFG/NMFS guidelines for maintaining instream flows in Mid-California coastal streams is unchanged from the May 22, 2000 draft guidelines.

These guidelines are recommended for use by permitting agencies, planning agencies and water resource development interests when taking proposed actions that would divert or act to reduce stream flows in California's mid-coastal watersheds containing anadromous salmonids. These guidelines do not constitute a final agency action for purposes of the National Environmental Policy Act or the California Environmental Quality Act. Nor do these guidelines define, or authorize take for purposes of State or Federal Endangered Species Acts. Rather, the guidelines are intended to preserve a level of flow that ensures that anadromous salmonids will not be adversely impacted by diversions. Altering stream flows outside these guidelines may impact salmonids by: blocking and/or delaying migration; reducing usable habitat; impacting habitat quality; stranding fish; entraining fish into poorly screened or unscreened diversions; and increased juvenile mortality resulting from increased water temperatures.

These joint guidelines are organized in two parts. The first, (*Terms and Conditions to be Incorporated into Water Rights Permits for Small Diversions)* consists of specific terms and conditions to be incorporated into water rights permits, issued by the State Water Resources Control Board (SWRCB) for small diversions where adequate site-specific biological data are not available. The guidelines were developed based on the biology and ecology of anadromous salmonids and their habitat requirements. The second part of these guidelines (*Implementation and Effectiveness Monitoring*) is programmatic in nature, addressing watershed-level initiatives necessary to ensure that the standards and protocols are consistent with conserving salmonids and their habitats.

The following guidelines are not developed for use in areas outside of the identified mid-coastal region. NMFS and DFG may develop similar guidelines for other regions of California in the future. Those guidelines should be based on anadromous salmonid habitat requirements, hydrologic characteristics, and other specific factors for those areas.

DRAFT

II. TERMS AND CONDITIONS TO BE INCORPORATED INTO WATER RIGHTS PERMITS FOR SMALL DIVERSIONS

1. Diversions > 3 cfs or > 200 acre-feet

For diversions larger than 3 cfs or greater than 200 acre-feet from streams in watersheds that currently or historically contained anadromous salmonids, water right permit applicants must consult with the NMFS and DFG to plan and conduct a site specific study for the purpose of determining appropriate flow related terms and conditions to be incorporated into the permitted water right. The study plan should include, at a minimum, the following:

1) A habitat based stream needs assessment that incorporates habitat, species, and life history criteria specific to each diverted stream or stream reach;

2) An evaluation of the existing level of impairment (diversion) and limiting factors for salmonid restoration based upon habitat, species, and life history specific criteria for each diverted stream or stream reach;

3) A specific proposal to provide periodic channel maintenance and flushing flows that are representative of the natural hydrograph; and

4) A plan to monitor the effectiveness of stipulated flows and procedures for making subsequent modifications, if necessary.

2. Small Diversions <3 cfs and <200 acre-feet

1) Geographic Limitations

For small diversions less than or equal to 3 cfs and less than or equal to 200 acre-feet, default guidelines have been developed for coastal watersheds from the Mattole River to San Francisco, and for coastal streams entering northern San Pablo Bay. This area generally includes streams within California's Mendocino, Sonoma, Marin, and Napa Counties, as well as a few coastal streams in Humboldt County south of the Eel River. The default guidelines are based on the hydrology and life history requirements of resident anadromous salmonids in this area. For streams within this area, the default guidelines may be incorporated into the terms and conditions of a permitted water right, in lieu of results from site-specific biological studies.

by passes other CEQA

DRAFT

For coastal streams north of the Mattole River or coastal watersheds to the south of San Francisco, DFG and NMFS have yet to develop detailed default guidelines for maintaining stream flows to protect fisheries resources downstream from water diversions. However, until such guidelines are developed, these agencies recommend that, in the absence of site-specific studies, in watersheds north of the Mattole River or south of San Francisco: 1) the diversion season for new water rights permits should be limited to the period of seasonal "high-flows", 2) additional on-stream reservoirs should not be constructed or permitted unless consistent with the exemptions provisions described below, 3) sufficient minimum bypass flows should be maintained to protect fisheries resources, 4) the cumulative maximum rate of withdrawal should be limited to maintain a near natural hydrograph and avoid cumulative impacts, 5) adequate passage and protection measures must be provided to facilitate instream movements of fishes and avoid entrainment in diversion intakes, and 6) the applicant should describe the project specific mechanism(s) that adequately ensure compliance with diversion limits. For coastal watersheds north of the Mattole River or south of San Francisco, default guidelines for the bounds of the diversion season, minimum bypass flows, and cumulative maximum rates of withdrawal have yet to be determined. Until detailed guidelines are available for diversions in these watersheds, applicants seeking diversion permits for those areas should consult with DFG and NMFS for stream flow recommendations.

2) <u>Seasonal Limits on Additional Diversions</u>:

The diversion season will be limited to the period December 15 to March 31. From April 1 to December 14 instantaneous inflow to the point of diversion must equal the instantaneous outflow to downstream reaches past the point of diversion.

Justification: In its water rights proceedings for the Russian River, Navarro River, and Napa River watersheds, the SWRCB has found that new water diversions should be confined to the period December 15 to March 31. This period is the time of highest winter flow and the time when water withdrawals would be least likely to adversely affect fisheries resources. Additional water withdrawals between April 1 and mid-May may adversely affect anadromous salmonids, because flows generally subside during that time, and juveniles typically emigrate during the higher flow events in that period. Additional water withdrawals between May 1 and October 1 may adversely affect salmonids, because rainfall in north-central coastal streams is minimal during that period, and diversions during that time would probably reduce the availability of already limited habitat for juvenile salmonids. Additional water withdrawals between September 1 and December 15 may unnecessarily affect salmonids, because that is a time when flows are relatively low, and high flows are infrequent and sporadic.

3) <u>No Additional Permitting of Small On-stream Reservoirs</u>:

Water diversion projects requiring new permits should avoid construction or maintenance of on-stream dams and reservoirs, including existing unpermitted storage ponds. Thus, storage must be to an off-stream reservoir. Exceptions are provided for special circumstances involving Class III streams as defined by 14 CCR 916, riparian management regulations for protecting watercourses and lake protection zones (see Exemptions below).

Justification: On-stream reservoirs should be prohibited, because they 1) eliminate, within the reservoir footprint, free-flowing stream habitat that may either support listed salmonids or the production of riffle-dwelling aquatic invertebrates that serve as food sources for downstream fishes (Corrarino and Brusven 1983; Resh and Rosenberg 1984; Keup 1988), 2) eliminate or reduce the magnitude and frequency of naturally occurring intermediate and high flows necessary for natural channel maintenance processes, 3) trap coarse bedload material and impede bedload transport, 4) act as barriers to migrating fishes, and 5) provide habitat for non-native aquatic species (*e.g.*, bullfrogs).

4) <u>Maintenance of Minimum Bypass Flows</u>:

Provide bypass flow regimes that adequately protect salmonids and aquatic resources in reaches downstream from the point of diversion. The determination of the bypass flow's adequacy can be based on site specific biological investigations conducted in consultation with NMFS and DFG, or in the absence of site-specific data, it would be not less than the estimated unimpaired February median flow at the point of diversion.

Justification: The unimpaired February median flow guideline is based partly on the observation that (at relatively low to moderate flows) available spawning and incubation habitat is generally positively correlated with discharge, but that naturally higher flows must be sustained for a substantial period of time in order to have "effective spawning and incubation habitat". The February median flow is a conservatively high bypass flow because it conserves "typical" winter flows to which native fishes are adapted. February is generally the wettest month in the 4-county area, and therefore the long-term February median flow is a hydrologic metric that permits diversions only during the higher flows of winter. This is appropriate given uncertainties regarding site specific flow needs for numerous aquatic biological processes (including both invertebrate and vertebrate production). However, it must be recognized that a minimum bypass flow equivalent to the February median does not protect all stream functions including channel maintenance flows, migratory flows in headwaters, and in many small watersheds, spawning flows for salmonids. To protect these latter functions it is necessary to protect the natural hydrograph as described in Item 5 below. The unimpaired February median flow can be estimated using a modification of the SWRCB Stream Simulation model for the Russian River Watershed Region or comparable hydrologic analytical techniques.

5) <u>Protection of the Natural Hydrograph and Avoidance of Cumulative Impacts:</u>

The diversion will be operated with a maximum rate of withdrawal that preserves a natural hydrograph with no appreciable diminishment (<5%) in the frequency and magnitude of unimpaired high flows necessary for channel maintenance (e.g., unimpaired flows with a recurrence interval of 1.5 or 2 years). The diversion will also not appreciably reduce the frequency and magnitude of unimpaired moderate and high flows (*e.g.*, flows higher than median February) used by migrating and spawning fishes in small streams. Unless there is compelling site-specific biological and hydrologic information indicating that additional water can be diverted without adversely impacting anadromous salmonids, diversions should not be permitted or otherwise sanctioned if 1) the <u>cumulative</u> maximum rate of instantaneous withdrawal at the point of diversion exceeds a flow rate equivalent to 15% of the estimated "winter 20% exceedence flow" <u>OR</u> 2) the total cumulative volume of water to be diverted from the stream at historical points of anadromy exceeds 10% of the unimpaired runoff between October 1 and March 31 during normal water years. For projects contributing to a cumulative diversion of 5 to 10% of the normal unimpaired runoff between October 1 and March 31, hydrologic analysis must demonstrate that the project will not cause or exacerbate significant adverse cumulative effects to migration and spawning flows for salmonids. The "winter 20% exceedence flow" is the 20% exceedence value of the stream's daily average flow duration curve for the period December 15 to March 31. Cumulative reduction refers to the effects of this and other permitted or licensed projects as well as diversions under riparian rights.

Justification: Natural, periodic, intermediate and high flows should be maintained downstream of diversion sites (Barinaga 1996; Poff et al. 1997). High flows are essential for 1) cleansing fine sediments from coarse substrates, 2) removing encroaching vegetation and contributing to the deposition of instream woody cover, and 3) serving as cues for and facilitating the migratory movements of fishes. Protection of intermediate and high flows during winter months must be accomplished through an assessment of cumulative impacts and placing limits on the cumulative rate of instantaneous water withdrawals from the stream, or on the total volume of water diverted. A discussion of the need for and rationale for limiting cumulative maximum instantaneous withdrawals to a portion of the "winter 20% exceedence flow" in northern coastal California streams is provided in NMFS (2000). Procedures for assessing cumulative impacts of water diversions based on the cumulative total volume of diverted water are described in Addendum A.

6) Fish Passage and Protection Measures:

The potential effect of stream flow diversions on upstream and downstream movements of anadromous salmonids must be addressed. If anadromous salmonids have the likely potential to ascend the stream to the point of diversion, then adequate passage facilities and screening at the diversion intake must be provided. Screening must be in accordance with NMFS and DFG's screening criteria.

Justification: Diversion structures and instream reservoirs may block fishes from reaching their natal spawning areas. Diversion structures also have the potential to entrain fishes, with resulting mortality.

7) **Special circumstances allowing onstream reservoirs:**

If a proposed diversion is located 1) in a stream reach where fishes or non-fish aquatic species were not historically present upstream, and 2) where the project could not contribute to a cumulative reduction of more than 10% of the natural instantaneous flow in any reach where fish are at least seasonally present, and 3) where the project would not cause the dewatering of any fishless stream reach supporting non-fish aquatic species, then no stream flow or fish passage protection measures are required. By cumulative reduction we refer to the effects of this and other permitted or licensed projects as well as diversions under riparian rights. For diversion sites meeting the above three criteria, on-stream reservoirs may be permitted.

Justification: The need for the above instream flow and fish protection measures is dependent upon the quality of the stream at the diversion site. Instream diversions and on-stream reservoirs on a limited number of ephemeral headwater streams naturally without fish or other aquatic species (*i.e.*, Class 3 streams, under 14 CCR 916) will not significantly impact fisheries resources, if the flows of streams with fishes (*i.e.*, Class 1 streams, under 14 CCR 916) are not reduced by more than10% from unimpaired levels. Exemptions under the above criteria will enable water users to develop small on-stream reservoirs while ensuring that stream reaches containing fishes (either year-round or seasonally) will not have additional on-stream dams or stream flows reduced more than 10% from unimpaired levels. Stream reaches containing aquatic species without fishes (*i.e*, Class 2 streams, under 14 CCR 916), will not be dewatered. These exemptions are consistent with allocating water for beneficial uses and protecting fishery resources.

8) <u>Quantify All Water Rights of Applicant</u>

To facilitate assessment of stream diversion impacts to fisheries, the applicant must identify all other basis of rights (appropriative, riparian, adobe, pre-1914), in streams potentially affected by the proposed diversion.

Justification: The determinations of maximum rate of withdrawal and potential impacts of cumulative withdrawals require information concerning all water withdrawals within the impacted watershed. Records concerning existing water rights are limited. Applicants seeking additional appropriative rights should provide known information concerning their diversion activities within the affected watershed.

9) <u>Compliance and Monitoring Measures</u>:

Prior to issuance of permit, the applicant must identify, to the satisfaction of NMFS, DFG, and the SWRCB the mechanism(s) that assure that the bypass flows will be maintained and rates of diversion will not be exceeded at the project. The applicant will provide a description of mechanism(s) for assuring bypass flows and rates of diversion to the SWRCB. The SWRCB will provide this information to NMFS and DFG for review and comment. Diversion projects will provide DFG personnel access to all points of diversion and places of use for the purpose of conducting routine and or random monitoring and compliance inspections.

However, the responsibility for ensuring compliance and enforcement of water rights issued by the SWRCB and/or any other permit or regulatory instrument that approves or allows water diversion or causes reduction in stream flows, rests with that permitting agency.

Justification: In order to protect anadromous salmonid habitat, mechanisms must be provided to ensure that bypass flows and constraints on diversion rates are maintained. Mechanisms to verify compliance with permit conditions may vary and be dependent on site-specific conditions. The determination of the specific mechanisms for assuring compliance with the diversion guidelines is the responsibility of the applicant and subject to approval by NMFS, DFG, and SWRCB.

DRAFT

III COMPLIANCE AND EFFECTIVENESS MONITORING

Inherent in the application of this, as well as any other, instream flow standard setting technique is the need for effectiveness monitoring to address and corroborate assumptions used in developing the flow standard. In addition, a prerequisite for reasonable flow allocation and habitat protection, is an accounting of existing diversions and enforcement of unpermitted diversions. It is essential, if instream resources are to be protected and over-allocation is to be avoided, that an accurate evaluation of all existing diversions be conducted prior to the issuance of any new water rights permits. Therefore, DFG and NMFS recommend the following initiatives:

1) Program to Verify Effectiveness and Refine the Flow Standard as Necessary

The SWRCB, DFG, and NMFS will cooperate in the development and implementation of an evaluation plan to monitor the effectiveness of flow standards being applied in the water rights process. This program should include specific monitoring activities to determine whether the standard provides a consistent and protective level of salmonid habitat conservation for streams of various size, order, elevation and geomorphic characteristics. The effectiveness monitoring program should also contain a protocol for making any refinements to the flow standard, as necessary to mitigate adverse affects on anadromous salmonid resources and their habitats.

2) Compliance and Enforcement Program

A compliance and enforcement program should be developed. This program should include flow gaging and routine, random compliance inspections. This program should be focused on a watershed approach and include the installation of stream flow gaging and recording devices at key locations within each stream basin for determining compliance with bypass flow requirements and current level of impairment. In addition, a separate schedule for routine, random compliance inspections should be developed for each watershed, based upon the level of impairment and sensitivity of anadromous salmonid habitat. As part of this program the SWRCB should require applicants to develop and implement measures that will ensure compliance with the bypass terms. The plans should specify measuring and recording devices and bypass facilities to be installed, the criteria for operation of the reservoir, and other measures that will be taken by the applicant to confirm compliance with permit terms. DFG and NMFS encourage water rights permit applicants to install "passive" bypass facilities (*i.e.*, facilities that will automatically bypass flows without any action by the permittee) whenever feasible. The plan should also include a measure for documenting that facilities have been installed and are being maintained.

DRAFT

3) Preventing Stream Over-Allocation

In order to prevent the over-allocation of anadromous salmonid streams by new diversions and to identify those streams currently over-allocated, it is necessary to document actual and potential levels of impairment. Prior to issuance of any new water rights the SWRCB should provide an evaluation and comprehensive accounting of all diversions currently in place including a disclosure of all basis of right in effect on the stream to be diverted and quantify the total maximum volume and maximum rate of withdrawal possible at any given time including rights not fully and/or currently exercised. The results of this evaluation should be compared on a month by month basis to the estimated unimpaired hydrograph to ensure that sufficient flow remains in the stream to provide a sufficient minimum bypass flow to protect salmonids in downstream reaches. Further, that the maximum cumulative rate of withdrawal from proposed and existing diversions will not appreciably diminish the natural hydrograph (<5%) in the frequency and magnitude of unimpaired high flows necessary for channel maintenance and will not appreciably reduce the frequency and magnitude of unimpaired moderate and high flows (*e.g.*, flows higher than median February) used by migrating and spawning fishes.

DRAFT

Addendum A

Procedures for assessing cumulative impacts of water diversions based on the cumulative total volume of diverted water

DRAFT

Procedures for assessing cumulative impacts of water diversions based on the cumulative total volume of diverted water

Determination of water availability:

Before issuing any new Water Rights permits, the State Water Resources Control Board (SWRCB) must first determine whether water is available for diversion. This determination is achieved through a Water Availability Analysis (WAA). Among other things, the WAA must estimate expected unimpaired stream flow (the natural flow without diversions) at the diversion site. In addition, it must then consider the water that has already been allocated to existing water rights holders (both riparian and senior appropriative) and the water that is required for the protection of public trust resources.

Requirements for resource protection based on potential cumulative impacts:

Minimum bypass flows must be maintained to ensure that threatened and endangered salmonid species are protected. At the same time, additional mechanisms must be employed to conserve intermediate and high flows (*i.e.*, maintaining a near natural hydrograph) so that other life history requirements of these species are met (see guidelines section for justification).

In the central coastal counties (Napa, Marin, Sonoma, and Mendocino), near natural hydrographs can be preserved by 1) limiting cumulative maximum instantaneous rates of withdrawal consistent with the DFG and NMFS guidelines (*i.e.*, 15% of the "winter 20% exceedence flow"), or 2) by limiting the cumulative volume of water diverted from the watershed. The guidelines section of this document addresses preserving the natural hydrograph using the "maximum instantaneous rate of withdrawal" approach. This addendum describes an alternative "volumetric" cumulative impact assessment method based on the total volume of water being diverted.

An analysis of site-specific flow requirements of anadromous salmonids in many western streams indicates that in small watersheds the optimal flows for spawning are variable, and often higher than the long-term, unimpaired February median flow (Hatfield and Bruce 2000). Hydrologic analysis indicates that adequate spawning flows, and near natural hydrographs, are generally maintained when the natural volume of winter runoff is impaired (*i.e.*, reduced) by less than 10% (SWRCB unpublished data). Spawning habitat for anadromous salmonids can be adversely affected by diverting more than 10% of winter runoff. Cumulative diversions of even 5 to 10% of annual runoff can also impact spawning habitats if the diversions reduce stream flows to minimum levels for several days during critical spawning periods in early winter.

Determining the Cumulative Flow Impairment Index (CFII):

To evaluate the potential cumulative effects of water diversions using a "volumetric" approach, the volume of water that is naturally available must be compared with the total volume of water that is, or can be, legally diverted from the watershed through existing water rights. The potential level of impairment to stream flow caused by these cumulative diversions can be evaluated by calculating the Cumulative Flow Impairment Index (CFII), as follows:

$$\text{CFII} = \frac{\text{Cumulative Diverted Volume (CDV)}}{\text{Estimated Unimpaired Runoff (EUR)}}$$

where,

CDV = potential volume of water diverted under all bases of right between October 1 and March 31 in a normal water year (in AF)

EUR = estimated volume of surface flow in the stream passing the point of interest between December 15 and March 31 in a normal water year (in AF)

Calculating the Cumulative Diverted Volume portion of the equation (Impaired flow):

The Cumulative Diverted Volume (CDV) is the volume of water diverted under all water rights potentially affecting the stream flow at a given Point of Interest (Points of Interest are discussed in more detail below). An October 1 to March 31 season is used to calculate the CDV because it reflects the season of diversion for many existing permits. Therefore, use of the CDV season facilitates a more accurate assessment of the cumulative effect of authorized diversions upon flows within a watershed. Calculations of the CDV must include all existing legal diversions (including pre-1914 rights, riparian rights, small domestic and stockpond registrations, and other appropriative rights) together with the proposed project under consideration for a new water right. The computation of CDV is done for average (*i.e.*, normal) water years.

If a portion of the direct or riparian diversion is highly unlikely to occur during most or all of the CDV season, then that portion of the volume of riparian or direct diversion may be discounted when computing the CDV. This is appropriate in situations with year-round water rights that are typically not exercised during the winter months (*e.g.*, when irrigation of a particular crop does not occur during wet winter months). However, riparian diversions for frost protection must be included when calculating CDV. All computations of CDV must be accompanied by a list of the diversions used in the calculation. The list must also include: 1) the season of diversion, 2) the potential maximum instantaneous rate of diversion, 3) the potential maximum volume of diversion, 4) the existing water rights excluded from the computations, and 5) any other assumptions related to the calculations for each diversion listed.

Calculating the Estimated Unimpaired Runoff portion of the equation (Unimpaired flow):

The Estimated Unimpaired Runoff (EUR) is calculated for the high flow (winter) season from December 15 to March 31. This season represents the period during which it is assumed that some water may still be available for diversion without additional environmental impact. All computations must be done using standard hydrologic techniques that may include prorating known gauge data, application of precipitation runoff models, or other accepted methods. Calculations of EUR (unimpaired flow) will be accompanied with descriptions of computational methods, input data, data sources, and assumptions sufficient for reviewers to fully understand and replicate the results. As with the CDV, these computations are done for average (*i.e.*, normal) water years.

Locations requiring CFII calculations for a project:

A CFII is typically calculated for several Points of Interest (POI's) within the watershed. Generally a POI is calculated at the Point of Diversion (POD) and then again for points immediately downstream at each confluence of a major intervening tributary between the project site and the mainstem of coastal rivers. In the case of small mainstem coastal streams (*e.g.*, Sonoma Creek), points of interest extend to the stream's estuary.

The location of the Points of Interest requiring CFII values will be determined by DFG and NMFS staff. To ensure consistency, POI's will be provided directly by NMFS and DFG to SWRCB staff for dissemination to Applicants, their consultants, and other interested parties.

Level of potential cumulative impact based on the CFII calculations:

The level of impairment identified by the CFII will determine the likely study effort needed to address the significance of cumulative impacts of the new water right project.

DRAFT

- If the CFII is greater than 10%, then there is a reasonable likelihood of significant cumulative impacts. When the CFII is greater than 10%, site specific studies will be required to assess impacts and the water right permit Applicant is referred to NMFS and DFG for the scoping of site-specific fisheries studies to assess these impacts.

- When the CFII is between 5 and 10%, the Applicant must provide additional hydrologic analysis documenting the estimated effects of cumulative diversions on the stream hydrograph at the POI's during three representative normal and two representative dry years. If the natural hydrograph is appreciably impaired during the migratory and spawning period of anadromous salmonid species, additional site specific study may be warranted.

- If the CFII is less than 5%, there is little chance of significant cumulative impacts due to the diversion and the project does not require additional studies to assess these impacts.

Scope and purpose of site specific studies:

Site-specific studies prompted by a CFII greater than 10% (or when there is an appreciable impairment of the hydrograph on projects with CFII between 5-10%) are performed to establish terms and conditions that ensure that habitats for anadromous salmonids are not further degraded. For most projects, three issues need to be addressed:

1) What are the cumulative effects of this and other projects on channel maintenance (flushing) flows needed to protect geomorphological processes downstream from the project site? Does the project under consideration contribute to a significant adverse effect on flushing flows needed to maintain the stream channel and avoid exacerbating stream sedimentation? Does the project affect the timing of the opening or closure of estuarine mouths with sand bars?

2) What minimum bypass flow and maximum instantaneous rate of withdrawal are needed for the project to protect spawning habitat for anadromous salmonids downstream from the project site?

3) What minimum bypass flow and maximum instantaneous rate of withdrawal are needed for the project to facilitate migratory movements of anadromous salmonids downstream from the diversion site(s)?

DRAFT

The Applicant should consult with NMFS and DFG concerning the scope and methods of site-specific studies to address these issues. Performance of site-specific studies does not guarantee that stream flow terms and conditions will be consistent with an economically viable project.

DRAFT

REFERENCES

Barinaga, M. 1996. A recipe for river recovery? Science 273: 1648-1650.

Corrarino, C.A., and M.A. Brusven. 1988. The effects of reduced stream discharge on insect drift and stranding of near shore insects. Freshwat. Invertebr. Biol. 2:88-98.

Hatfield, T., and J. Bruce: 2000. Predicting salmonid habitat-flow relationships for streams from Western North America. N. Am. J. Fish. Mgmt. 20: 1005-1015.

Keup. L.E. 1988. Invertebrate fish food resources of lotic environments. Instream Flow Information Paper No. 24. U.S. Fish Wildl. Serv. Biol. Rep. 88(13). 96 pp.

National Marine Fisheries Service (NMFS). 2000. Comments on the State Water Resources Control Board report on proposed actions on pending water right applications within the Russian River watershed and NMFS draft recommended guidelines for maintaining instream flows to protect fisheries resources in tributaries of the Russian River. NMFS Santa Rosa, California Field Office, January 2000. 124 pp.

Poff, N.L. and seven coauthors. 1997. The natural flow regime: a paradigm for river conservation and restoration. Bioscience 47: 769-784.

Resh, V.H., and D.M. Rosenberg. 1984. The ecology of Aquatic Insects. Praeger Scientific, New York, NY. 400 pp.

State Water Resources Control Board (SWRCB). 2001. Assessing site specific and cumulative impacts on anadromous fishery resources in coastal watersheds in Northern California. Division of Water Rights, Staff Report. January 23, 2001. 6 pp.